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## THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

### PRELIMINARY ANNOUNCEMENT OF THE FOURTH ST. LOUIS MEETING

Edited by Dr. HENRY B. WARD

PERMANENT SECRETARY

#### INTRODUCTION

ST. LOUIS, the great central metropolis, as host will welcome the association on Monday, December 30, for its ninety-seventh meeting. The programs of the various sections and societies, which are outlined in their main features in this preliminary announcement, not only fill the entire week but even in a few cases anticipate the official opening of the sessions. A complete record of events will be given in the official programs distributed to members and guests on registering in St. Louis. The interest and importance of the meeting is clearly evidenced in the outline of events given herein.

The association has already held three conspicuously

successful meetings in St. Louis. The first, in August, 1878, was the twenty-seventh meeting of the association and represented also the second time during thirty years of association history that it had ventured west of the Mississippi River. That season was one "of unprecedented heat," and also a time of sensational reports regarding the spread up river of an epidemic of yellow fever then increasing in the southern states. The secretary of that first St. Louis meeting reported that the health of the city was unusually good and not a single case of illness was reported among the members and guests in attendance. One hundred and thirty-four signed the register and 218 new members were elected. One hundred and three papers were

listed for the program. The total membership of the association at that time had not reached one thousand.

The second St. Louis meeting, which was the fifty-third meeting of the association, was held from December 26, 1903, to January 2, 1904; it was the sixth meeting west of the Mississippi River. The total attendance was 466 and twenty-one affiliated societies were reported as meeting with the association. The association had just embarked on the period of rapid growth and at that date had enrolled 4,075 members. The meeting was conspicuous for its activity and the interest in it had been vigorously stimulated by the approaching Louisiana Purchase Exposition, which opened in St. Louis the following May.

Naturally the proposed International Congress of Arts and Sciences received much attention and as subsequently carried out was regarded as an outstanding feature in the progress of science. Its proceedings were issued in a series of eight volumes containing nearly six thousand pages and constituted a comprehensive presentation of human progress.

The third St. Louis meeting, which was the seventy-second in the record of the association, covered the week from December 29, 1919, to January 3, 1920. At this time a new constitution was adopted, perfecting the plan that had been under study for some years and establishing the present organization of sections and associated societies. The change was in keeping with the rapid growth of the association which had by that date reached a total of over eleven thousand in membership, nearly three times the enrolment in 1903, and over eleven times the membership in 1878 when the association first met in St. Louis.

Located in 1764 at a strategic point on the great river, St. Louis was for forty years the center of commerce for the French territory known as the Louisiana Purchase. When that area in 1803 came into our nation, more than doubling its previous extent, the city acquired even greater importance. The development of river traffic made St. Louis the focal point of what is now the largest inland waterways system in the world. Its great bridges, planned at an early date to give accessibility to the east are triumphs of engineering skill. Its great drug and chemical companies with extensive manufacturing enterprises in many other lines, its network of radiating trunk lines at railways connecting East and West, and its proximity to rich supplies of coal, oil and other raw materials have built up commercial interests far reaching in importance.

Among the outstanding objects of scientific interest in the city stands, first, the Jefferson Memorial with collections recording the early history of the city and state, of French and Spanish pioneers and adventurers and of earlier native races; the old court house; the U. S. Grant cabin; the Zoo and the Arena in Forest Park; the huge municipal airport, and the world-

famous Missouri Botanical Garden, founded by Henry Shaw. These and other features of interest to scientific men should be in mind when the trip to St. Louis is being planned.

St. Louis University and Washington University, with their medical schools, hospitals and other significant features, join with numerous other educational institutions to welcome the visiting scientists and afford them space and equipment for meetings, discussions and demonstrations. Many sections and societies are taking advantage of these opportunities.

#### HOTEL HEADQUARTERS

General headquarters for the association, including several of the sections, will be at the New Jefferson Hotel. Since not all can be accommodated at this hotel, a large number of other hotels in St. Louis are available. Headquarters for the various special societies have been assigned as follows:

*New Jefferson:* Sections on Chemistry, Geology and Geography, Anthropology, Social and Economic Sciences, Engineering, Medical Sciences and Agriculture; Entomological Society of America; American Association of Economic Entomologists; American Society of Parasitologists; Wilson Ornithological Club; Metric Association; American Society of Agronomy; Potato Association of America; Society of the Sigma Xi; United Chapters of Phi Beta Kappa; Honor Society of Phi Kappa Phi; American Association of University Professors; Pi Gamma Mu; Sigma Delta Epsilon Women's Graduate Fraternity.

*Chase:* Section on Physics; American Physical Society; American Association of Physics Teachers; National Council of Geography Teachers; Association of American Geographers.

*Coronado:* Section on Mathematics; American Mathematical Society; Mathematical Association of America; National Council of Teachers of Mathematics; Econometric Society; American Society for Horticultural Science.

*Mayfair:* American Meteorological Society; Section on Astronomy; Section on Historical and Philological Sciences; History of Science Society.

*Melbourne:* American Nature Study Society; Seismological Society of America.

*Statler:* Sections on Botanical Sciences, Psychology and Education; Botanical Society of America; American Phytopathological Society; American Society of Plant Physiologists; Mycological Society of America; American Fern Society; American Society of Naturalists; Genetics Society of America; American Division, International Association for Dental Research; Gamma Alpha Graduate Scientific Fraternity.

*Warwick:* Section on Zoological Sciences; Phi Sigma Society; Ecological Society of America.

#### RAILROAD RATES

Reduced railway rates on the receipt certificate plan have been granted by almost all railroads in the United



States and Canada. Persons attending the meeting should purchase a first-class, one-way ticket to St. Louis, securing a receipt certificate reading "For the American Association for the Advancement of Science and Associated Societies." The certificate must be left at the registration desk to be called for later in the same place. Each person presenting an endorsed and validated certificate may purchase a return ticket for one third of the regular fare on the same route as used in going to St. Louis. Tickets to St. Louis from many points may be purchased between December 25 and January 1, although from far western points they may be purchased as early as December 23. Return tickets must be purchased by January 8.

A number of the railroads in the East and Midwest have announced special excursion fares for the Christmas holidays. The rate will be about the same as the special convention fares arranged for the St. Louis meeting.

In view of possible further reduction of fares and the various periods when going tickets may be purchased on the certificate plan, as well as on the special Christmas fares, it is advisable to consult the local ticket agent.

#### REGISTRATION

The main registration headquarters will be in the new Municipal Auditorium, where registration facilities will be opened on Monday, December 30, and maintained throughout the meeting. Any one interested in the advancement of science or education may register upon payment of the registration fee of \$1.00.

Each registrant receives a copy of the General Program, an identification card and a badge. Registration is necessary to obtain validation of certificates for reduced railway fares. Each registrant is entitled to the validation of his own railway certificate. At the registration desk reservations may be made for all excursions and banquets. The registration desk will also handle all mail, telegrams, etc., and furnish information as desired.

#### GENERAL SESSIONS

The evening sessions of the association will be held in the Opera House at the Municipal Auditorium and will open at 8:15. On Monday the program will include a welcome to the association and associated societies extended formally by representatives of the city and the host institutions. The main address will be delivered by the retiring president, Dr. Edward L. Thorndike, of Teachers College, Columbia University, on "Science and Values." The address will be followed by a reception tendered to the association and guests by the St. Louis Local Committee.

On Tuesday evening the Sigma Xi address is to be given by John Bellamy Taylor, of the General Elec-

tric Company, on the topic "The Electric Eye and the Human Eye."

On Wednesday evening the first of a series of annual lectures sponsored by the United Chapters of Phi Beta Kappa, emphasizing the cultural aspects of science, will be given by Professor Frederick J. E. Woodbridge, of Columbia University, on "The Claims of Science."

On Thursday evening the address will be given by Dr. Harold G. Moulton, president and director of the Brookings Institution in Washington, D. C. The topic of the address is "The Scientific Method in the Investigation of Economic Problems."

A series of important scientific addresses of general import and appealing to more than a single section is to be given at 4:30 in the afternoon. On Monday afternoon Dr. B. A. Houssay, Harvard Medical School, will give an address on "Hypophysis and Metabolism." Dr. Karl F. Meyer, of the G. W. Hooper Foundation, University of California, will speak on Tuesday afternoon on the subject, "Plague, Past and Present." On the same afternoon Dr. Erwin H. Barbour, of the University of Nebraska, will deliver an illustrated address on "The Proboscidea of the Plains." On Tuesday afternoon also will be given the address of Professor Frederick Slocum, of Wesleyan University, retiring vice-president of the Section on Astronomy, who will speak on "The Changing Picture of the Universe."

Dr. Stanhope Bayne-Jones, of the Yale University School of Medicine, will discuss on Wednesday afternoon "Bacterial Poisons and Their Antidotes." This is the vice-presidential address of the Section on Medical Sciences. On the same afternoon Dr. Vern O. Knudsen, of the University of California, recipient last year of the twelfth Association Prize, will speak on the subject of his prize paper, "The Absorption of Sound in Gases." Wednesday afternoon will be used also for an address by Carl Snyder, retiring vice-president of the Section on Social and Economic Sciences. He will speak on "The Rule of Capitalism in Civilization."

On Thursday afternoon the twelfth Josiah Willard Gibbs Lecture under the auspices of the American Mathematical Society will be given by Dean Vannevar Bush, of the Massachusetts Institute of Technology, on the subject "Mechanical Analysis." On the same afternoon Dr. V. K. Zworykin, of the Radio Corporation of America, will give a lecture on "Electron Optical Systems and Their Applications." Thursday afternoon also is announced for the address of Dr. Solon J. Buck, of the National Archives, retiring vice-president of the Section on Historical and Philological Sciences; he will speak on "The National Archives and the Advancement of Science."

## VICE-PRESIDENTIAL ADDRESSES

The addresses of the vice-presidents are announced in the subjoined schedule and are arranged in the order of their presentation.

*Section on Geology and Geography (E):* Monday, 11: 00 A. M. Reverend James B. Macelwane, S.J., of St. Louis University, on "Problems and Progress on the Seismologico-Geological Frontier."

*Section on Agriculture (O):* Tuesday, 9: 30 A. M. Dean Jacob G. Lipman, of Rutgers University, on "The Conservation of our Land Resources."

*Section on Mathematics (A):* Tuesday afternoon. Professor R. D. Carmichael, of the University of Illinois, on "Linear Differential Equations of Infinite Order."

*Section on Botanical Sciences (G):* Tuesday afternoon. Dr. Bernard O. Dodge, of the New York Botanical Garden, on "The Genetics of the Ascomycete Neurospora."

*Section on Astronomy (D):* Tuesday, 4: 30 P. M. Professor Frederick Slocum, of Wesleyan University, on "The Changing Picture of the Universe."

*Section on Psychology (I):* Tuesday evening. Professor John E. Anderson, of the University of Minnesota, on "Child Development and the Interpretation of Behavior."

*Section on Education (Q):* Tuesday evening. Professor Guy T. Buswell, of the University of Chicago, on "Some Contributions of the Study of Eye Movements to the Psychology of Perception."

*Section on Physics (B):* Wednesday morning. Dr. Henry G. Gale, of the University of Chicago, on "The Diffraction Grating."

*Section on Medical Sciences (N):* Wednesday, 4: 30 P. M. Dr. Stanhope Bayne-Jones, of Yale University School of Medicine, on "Bacterial Poisons and Their Antidotes."

*Section on Zoological Sciences (F):* Wednesday evening. Dr. Oscar Riddle, of the Carnegie Institution of Washington, on "The Confusion of Tongues."

*Section on Historical and Philological Sciences (L):* Thursday, 4: 30 P. M. Dr. Solon J. Buck, director of publications of the National Archives, on "The National Archives and the Advancement of Science."

*Section on Chemistry (C):* Thursday evening. Professor Joel H. Hildebrand, of the University of California, on "Dipole Attraction and Hydrogen Bond Formation in Their Relation to Solubility."

*Section on Anthropology (H):* Friday evening. Professor Melville J. Herskovits, of Northwestern University, on "Applied Anthropology and the American Anthropologist."

*Section on Social and Economic Sciences (K):* Wednesday, 4: 30 P. M. Mr. Carl Snyder, of the Federal Reserve Bank, New York City, on "The Rule of Capitalism in Civilization."

*Section on Engineering (M):* (Time not yet fixed). Dr. Charles E. Skinner, of the Westinghouse Electric and Manufacturing Company, on "Civilization's Debt to the Engineer."

## PRESS SERVICE

The exposition of science in the press is essentially a compromise between what scientific men and women would like to see and what the layman readers of the press would most prefer to read. Such a compromise has many angles that are not fully understood by all concerned. For the St. Louis meeting there is planned a meeting, of the most informal kind, between the section and society secretaries and the representatives of the press at which both sides will be prepared to answer frankly any and all questions asked by the other regarding the broader principles or the technique of the popular presentation of science. Although the relations between science and the press have greatly improved during the past decade there are certain difficulties still to be overcome, and it is hoped that the way to their eventual solution may be cleared by informal, free and frank discussion.

## SCIENCE EXHIBITION

The annual science exhibition in connection with these meetings is to be held in the new Municipal Auditorium. It is believed that the membership will be attracted both by the quality and number of displays and demonstrations. The science library will have the 1935 science books and will furnish an opportunity to survey the product of scientific achievement as compiled in the year's output of books.

## OFFICIAL MEETINGS

The council of the association will convene at 2:00 on Monday afternoon and will hold further sessions at 9:00 each morning during the week.

The Academy Conference, consisting of official delegates from affiliated academies with designated representatives from the association, will hold its annual session for discussion at 4:00 on Monday afternoon. The Academy dinner will follow at 6:15 and will adjourn at 7:45 to attend the opening general session at 8:15.

The Secretaries' Conference, composed of all secretaries of sections and of affiliated societies, will meet for luncheon with members of the Executive Committee of the Association on Friday at 12:30. The formal session for discussion of the regular program will open immediately after luncheon.

## SOCIAL AFFAIRS

The joint smoker of the biological societies is to be held this year as usual, on Tuesday evening after the dinners and general session, in order to avoid conflicts with events announced for the early evening hours.

For Tuesday evening have been announced group



dinner for physicists, entomologists, phytopathologists, ecologists, ornithologists and the Phi Sigma Society, as well as the Sigma Xi buffet supper preceding the Sigma Xi address on that date. A joint luncheon for members of the Sections on Psychology and on Education has also been arranged for Tuesday noon. The geneticists will hold their annual luncheon on Tuesday noon.

Wednesday evening dinners include those of the mathematicians, zoologists, botanists, horticulturists and the American Nature Study Society. Luncheons have been planned for Wednesday noon by the parasitologists and the econometrists.

Thursday evening includes primarily the dinner of the naturalists, following which an address will be given by Dr. J. C. Merriam, president of the society. On that evening also will be held a dinner arranged by the St. Louis Section of the American Chemical Society in cooperation with the Section on Chemistry.

On Friday evening the annual dinner of the Section on Anthropology will be given, and on Saturday evening the dinner of the American Division of the International Association for Dental Research.

#### SECTIONAL AND SOCIETY PROGRAMS

The Section on Mathematics (A), the American Mathematical Society, the Mathematical Association of America and the National Council of Teachers of Mathematics will meet from Monday, December 30, to Friday, January 3. The Mathematical Association will meet on Monday morning and afternoon with joint sessions on Tuesday morning and afternoon, the Mathematical Society on Tuesday to Friday, and the National Council on Tuesday and Wednesday.

On Monday morning and afternoon the Mathematical Association will hold sessions for the reading of papers by invited speakers, including a report from the Commission on the Training and Utilization of Advanced Students of Mathematics. On Tuesday morning the Section on Mathematics, the Mathematical Association and the National Council will hold a joint session. A report of progress will be made on behalf of the Committee on the Place of Mathematics in the Secondary Schools, which is acting under the joint auspices of the Mathematical Association and the National Council. Following this, addresses will be given on the topic "The Purposes and Objectives of High School Mathematics," by William Betz, of the Rochester, N. Y., schools, representing the National Council, and by Professor W. W. Hart, of the University of Wisconsin, representing the Mathematical Association. During the latter part of Tuesday morning the Mathematical Society will hold its first meeting for the presentation of short papers. On Tuesday

afternoon a joint session of the section, the society and the association will be held. Professor R. D. Carmichael, of the University of Illinois, will give his address as retiring vice-president and chairman of the section, on the topic "Linear Differential Equations of Infinite Order," and by invitation of the society Professor J. L. Synge, of the University of Toronto, will speak on "Tensorial Methods in Dynamics."

Tentative arrangements have been made for a joint meeting on Thursday morning of the Econometric Society, the Institute of Mathematical Statistics and the American Mathematical Society. The twelfth Josiah Willard Gibbs Lecture, under the auspices of the society, will be delivered on Thursday afternoon at 4:30 by Dean Vannevar Bush on the topic "Mechanical Analysis." On the invitation of the society Professor G. Szegő will deliver a lecture entitled "Some Recent Investigations concerning Sections of Trigonometric and Related Series" at one of its sessions.

The headquarters for mathematicians will be the Coronado Hotel. A joint dinner for all mathematicians will be held on Wednesday evening.

The Section on Physics (B) will hold its meeting as usual jointly with the American Physical Society and the American Association of Physics Teachers. The joint session will be held on Wednesday morning, January 1, and will include three papers. One of these will be the address of the retiring president of the Physical Society, Dr. Robert W. Wood. The second paper will be delivered by Dr. A. H. Compton, previously retired president of the American Physical Society, on the subject "Recent Developments in Cosmic Rays." The address of the retiring vice-president of the section, Dr. Henry G. Gale, will be entitled "The Diffraction Grating." A joint session of the American Physical Society and the American Association of Physics Teachers will be held on Tuesday afternoon, December 31, on the subject "Photoelectricity." There will be a joint dinner of the two societies on Tuesday evening. The American Meteorological Society will meet on Monday and Tuesday. Two joint sessions are planned for Tuesday, one in the morning with the Association of American Geographers for climatological papers and one in the afternoon with the Section on Astronomy on the cosmic relations of the high atmosphere. At other sessions stress will be laid on the value in weather forecasting of vertical sections of the lower five or ten miles of the atmosphere and on methods for obtaining the required aerological data.

The Section on Chemistry (C) will hold sessions on Wednesday and Thursday, January 1 and 2. On Wednesday morning there will be a joint session of this section with the Section on Education and with the cooperation of the Division of Chemical Education of the American Chemical Society, for the second

of a series of three symposia on the relationships of the science of chemistry to education. The subject of this symposium will be "The Teaching of Chemistry." Professor Ross A. Baker, of the College of the City of New York, will act as chairman and will present the introduction, the title of which is "The Objectives of the Subject of Chemistry." Professor J. H. Simons, of Pennsylvania State College, will speak on "Teaching Chemistry for Its Cultural and Training Values." Professor J. C. Bailar, of the University of Illinois, will speak on "Teaching Chemistry for Its Prerequisite and Professional Values." "The Problem of the Laboratory and Lecture Demonstration" will be discussed by Professor H. C. Deming, of the University of Nebraska. Professor W. D. Harkins, of the University of Chicago, will speak on "Keeping Chemistry Teaching and the Text Books Modern," and "Special Problems in the Teaching of Chemistry" will be discussed by Professor Warren C. Johnson, of the University of Chicago. On Thursday there will be sessions for contributed papers both morning and afternoon. On Thursday evening a dinner has been arranged by the St. Louis Section of the American Chemical Society. Following the dinner the retiring vice-president of the section, Professor Joel H. Hildebrand, will give an address on "Dipole Attraction and Hydrogen Bond Formation in Their Relation to Solubility."

The Section on Astronomy (D) will meet on Tuesday and Wednesday, December 31 and January 1, and possibly on January 2. Sessions for contributed papers will be held on Tuesday and Wednesday mornings and Wednesday afternoon. On Tuesday afternoon a joint session with the American Meteorological Society will be held, at which papers of common interest to astronomers and meteorologists will be read. It is expected that reports will be made on the progress of investigations in the upper atmosphere and on other topics of cosmic-terrestrial interest. The address of the retiring vice-president, Professor Frederick Slocum, on "The Changing Picture of the Universe," will form a feature of the general program of the association on Tuesday at 4:30 P. M.

An astronomical exhibit is being arranged in connection with the program of the section. It is anticipated that the exhibit will be representative of the important observatories of the United States and Canada and will also feature the work of the amateur telescope makers, which was an unusual attraction at the Pittsburgh meeting.

The Section on Geology and Geography (E) will be in session on Monday, December 30, and Tuesday, December 31, thus making it possible for members of the Geological Society of America to attend the gathering of geologists in New York prior to the sessions in St. Louis. Both sessions on Monday will be held

jointly with the Seismological Society of America, and the papers scheduled for that day will pertain to subjects of interest to both seismologists and geologists. The address of the retiring vice-president, Rev. James B. Macelwane, S.J., of St. Louis University, on "Problems and Progress on the Seismologico-Geological Frontier," will be delivered at 11:00. Papers dealing with the geomorphology, structural and economic geology, stratigraphy and paleontology of the Mississippi Valley will be especially welcomed for presentation at the sessions to be held on Tuesday morning and afternoon. The Association of American Geographers will hold its meetings on December 30 and 31 and January 1; on these days programs of contributed papers will be given.

The Seismological Society of America is planning three sessions on Monday and Tuesday, December 30 and 31, for the reading of papers by members.

The National Council of Geography Teachers will meet in St. Louis on December 27 and 28 at the Hotel Chase. Prominent geographers from coast to coast will take part in the program, which will include the following topics: (1) The Content of Beginners' Geography, (2) Advertising Geography, (3) Professionalized Subject-Matter in Geography, (4) Geography in World Relationships, (5) Geography in the Senior High School.

The Section on Zoological Sciences (F) will hold its sessions on December 31 and January 1 and 2. The sessions of Tuesday morning and afternoon will be devoted to the reading of papers. On Wednesday morning the section will meet jointly with the Ecological Society of America, the American Society of Parasitologists and the Section on Medical Sciences. The business meeting will be held Wednesday noon, and Wednesday afternoon will be devoted to demonstrations. There will be a dinner for all zoologists on Wednesday at 6:30, immediately following which the vice-presidential address will be given by Dr. Oscar Riddle, of the Carnegie Institution of Washington, on the subject "The Confusion of Tongues." On Thursday morning sessions for the reading of papers are scheduled, as well as a joint session with the American Society of Parasitologists.

The American Society of Parasitologists will hold its meetings on Tuesday, Wednesday and Thursday, December 31 to January 2, with a program of 63 titles, including the papers presented for demonstration. The presidential address, "Some Unsolved Problems in the Parasitology of Amebiasis," will be given by Colonel Charles F. Craig, of Tulane University, on Wednesday morning at a session held jointly with the Sections on Medical Sciences and on Zoological Sciences. The annual luncheon and business meeting will



be held on Wednesday noon and the demonstration session on Wednesday afternoon.

The Entomological Society of America will meet on December 30 and 31. The annual business meeting will be held on Tuesday afternoon. On Tuesday evening the two entomological societies will attend the entomologists' banquet sponsored by the American Association of Economic Entomologists. This will be followed by the annual address of the Entomological Society of America, to be given by Dr. C. P. Clausen, who is in charge of Foreign Parasite Introductions for the U. S. Bureau of Entomology and Plant Quarantine.

The American Association of Economic Entomologists will meet on December 30 and 31 and January 1. Sessions of the Section of Plant Quarantine and Inspection will be held on Monday morning and afternoon and the session of the Section on Apiculture on Monday afternoon. The association will meet jointly with the Entomological Society of America at noon on Monday, at which time the president of the association will speak. The Section of Extension Entomology will hold a session on Monday evening. The business meeting of the association will be on Tuesday morning and sessions for the reading of papers will be held on Tuesday morning and afternoon and Wednesday morning. The Wednesday afternoon session will be devoted to a symposium on "Orchard Sanitation," under the direction of Professor J. J. Davis, of Lafayette, Ind., vice-president of the association.

The Wilson Ornithological Club will meet on December 29, 30 and 31. Members present Saturday afternoon will visit the Missouri Botanical Garden and participate in an all-day field trip on Sunday. About forty papers and moving picture films will be presented at the morning and afternoon sessions on Monday and Tuesday. Papers of special interest concerning life history studies of birds will be read by Dr. P. L. Errington, Dr. Rudolph Bennett, Dr. L. J. Cole, Dr. T. S. Roberts, Dr. Leonard Wing and Margaret M. Nice. The annual dinner on Tuesday evening will be followed by the presidential address of Dr. Josselyn Van Tyne and special events, including two guest speakers.

The Section on Botanical Sciences (G) will meet in joint session with the Botanical Society of America, the American Phytopathological Society, the American Society of Plant Physiologists and the Mycological Society of America on Tuesday afternoon. The retiring vice-presidential address by Dr. B. O. Dodge, of the New York Botanical Garden, on "Reproduction and Inheritance in Ascomycetes," will be followed by a symposium on "The Promise of Modern Botany for Human Welfare." Mr. Frederick D. Richey, of the U. S. Bureau of Plant Industry, will speak on the

botanist as a creator; Professor E. C. Stakman, of the University of Minnesota, will discuss the botanist as a protector; and Dr. George T. Moore, of the Missouri Botanical Garden, will discuss the botanist as a cultivator.

The Botanical Society of America plans joint sessions as follows: (1) with the Section on Botanical Sciences and affiliated societies on Tuesday afternoon; (2) with the Ecological Society of America on Wednesday afternoon; and (3) with the American Society of Naturalists and affiliated societies on Thursday afternoon. Meetings of the sections of the society will occupy the forenoons. Botanical exhibits and demonstrations of researches will be displayed in rooms near the session rooms. The annual dinner of the society will be held on Wednesday evening, following which the presidential address will be given by Professor E. J. Kraus, of the University of Chicago.

The American Society of Plant Physiologists will hold a joint session with the American Society for Horticultural Science on Wednesday morning, on the effect of light on plant activity (other than photosynthetic and x-ray effects). At the annual dinner of the society the Stephen Hales Prize award will be made for meritorious work in plant physiology, and a distinguished plant physiologist will be honored by a Charles Barnes life membership. Papers will be read by members of the society on Tuesday, Wednesday, Thursday and Friday mornings.

The Mycological Society of America will meet from Tuesday to Thursday, inclusive. At the close of the business session on Tuesday morning the retiring president, Dr. B. O. Dodge, will preside at a round-table discussion of problems dealing with the sexuality of the fungi. A joint session with the Section on Botanical Sciences will be held on Tuesday afternoon and another with the American Phytopathological Society on Wednesday afternoon. Opportunity will be given on Thursday afternoon for the making of mycological demonstrations and the holding of conferences. The remaining sessions will be given over to the reading of mycological papers. The society will unite with the American Phytopathological Society and the Botanical Society of America in the dinners held by these affiliated organizations.

The American Phytopathological Society will meet from Tuesday, December 31, to Friday, January 3, and will celebrate appropriately the quarter-centennial of its official journal, *Phytopathology*. The presidential address will be made by Dr. H. T. Güssow, Dominion botanist, of Ottawa. Joint sessions will be held with the Section on Botanical Sciences on Tuesday afternoon, with the Mycological Society of America on Wednesday afternoon, with the Genetics Society of America on Thursday morning and with the Potato

Association of America on Thursday afternoon. Round-table conferences are being planned for discussions of the interrelations of research and extension work, regional or national cooperation in research, and other topics. The annual dinner will be held on Tuesday evening.

The American Fern Society will hold a session for papers on Tuesday afternoon. Arrangements have been made for an exhibition of specimens.

The following societies related to the Sections on Zoological Sciences (F) and on Botanical Sciences (G) have announced plans for meeting in St. Louis. The Ecological Society of America has arranged a program to occupy three days, beginning on Tuesday, December 31, with a general session in the morning. For Tuesday afternoon it has planned a symposium on the ecological aspect of government operations, with Dr. Herbert Hanson as chairman. The annual dinner will be held on Tuesday evening, following which an address will be given by the president of the society, Dr. Walter P. Taylor. The society will meet jointly with the Section on Zoological Sciences on Wednesday morning and with the Botanical Society of America on Wednesday afternoon. On Thursday morning a session devoted to a discussion of forest and range ecology will be held, as well as a business meeting.

The newly organized and recently affiliated Limnological Society of America will hold its first annual meeting at St. Louis in conjunction with the association. It is planned to have at least one general session for the reading of papers, a program of invited papers and a short business meeting.

The Genetics Society of America will omit from this year's program sessions with short formal papers and will substitute for these sessions with informal demonstration papers. These sessions will be held on Tuesday, December 31, forenoon and afternoon. On Wednesday afternoon is scheduled a round-table conference on "Species from a Genetic Standpoint," with L. J. Stadler as leader and J. Clausen, Th. Dobzhansky and Sewall Wright as introducers. This will be a joint session with the Taxonomic Section of the Botanical Society, the Section on Zoological Sciences and the American Society of Naturalists. On Thursday forenoon will be held a joint round-table conference with the American Phytopathological Society, the American Society of Agronomy and the American Society for Horticultural Science, on "Genetics and Plant Breeding," with E. W. Lindstrom as leader and H. K. Hayes, M. J. Dorsey, S. L. Emsweller and J. C. Walker as introducers. The annual luncheon will be held on Tuesday.

The American Society of Naturalists is again sponsoring the annual Biologists' Smoker on Tuesday late

in the evening. On Wednesday afternoon it will hold a round-table conference on "Species from a Genetic Standpoint," with L. J. Stadler, J. Clausen, T. Dobzhansky and Sewall Wright as speakers. This will be a joint session with the Genetics Society of America, the Botanical Society of America and the Section on Zoological Sciences. The naturalists' symposium, on the subject of early man in America with particular reference to the Southwestern United States, will be held on Thursday afternoon, with Chester Stock, Ernst Antevs, Paul MacClintock, Frank H. H. Roberts, Edgar B. Howard and E. H. Sellards as the principal speakers. The dinner of the society will be held on Thursday evening, followed by an address by Dr. John C. Merriam, president of the Carnegie Institution of Washington, on "Extent and Rate of Human Evolution—the Asking of Critical Questions."

The American Nature Study Society will meet on December 30 and 31 and January 1. December 30 will be devoted to an excursion to the Museums, Missouri Botanical Garden and its Gray Summit orchid house, and the Webster Groves Nature-Study Society's Wayside Museum, where tea will be served. On the morning of December 31 the program will be a résumé of St. Louis in the field of nature study. The afternoon program will be on "More Recent Phases of Nature Study." On January 1 there will be a short business meeting, committee reports and a discussion of "Science Education" by leaders outstanding in the study of nature. The banquet will be held on the evening of January 1, when an illustrated lecture will be given by a noted scientist. Two exhibits are being planned, one in connection with the general science exhibit and the other at the American Nature Study headquarters.

The American Microscopical Society will hold its annual business meeting on Thursday, January 2, at 4:00 P. M.

The Phi Sigma Society will hold business meetings on Monday, December 30, and scientific sessions for the reading of papers by junior research workers on Tuesday, December 31. The dinner of the society will be held on Tuesday evening.

The Section on Anthropology (H) will hold its sessions on the mornings of Thursday to Saturday, January 2 to 4, in the Anatomical Laboratory of Washington University. On Thursday morning the program will center upon a discussion of comparative racial morphology, with especial reference to American Whites and American Negroes. G. A. Seib and R. J. Terry will discuss the muscular system; M. Trotter, G. D. Williams and W. W. Graves will consider certain phases of bone and soft part relationships. The Friday morning session will be devoted to the prehistory of the Mississippi Valley, with contributions from



Thorne Deuel, W. C. McKern, J. B. Griffin, G. K. Neumann and other mid-western archeologists. On Saturday morning there will be a round-table discussion of the integration of the several divisions of anthropology, both with one another and with related disciplines. On Friday night the section will hold its annual dinner with the retiring vice-president, Professor M. J. Herskovits, as the speaker. The weather permitting, a visit to the Cahokia Mound Group will be made.

The Section on Psychology (I) will meet from December 30 to January 1. A joint meeting with the Section on Education is planned for Tuesday afternoon, at which four papers on the general subject of maturation and learning will be read by members from the two sections who are doing research in this general field. The other program will be devoted to the reading of submitted papers by members of the section. On Tuesday noon there will be a joint luncheon of the Section on Psychology and the Section on Education, at which addresses will be given by Professor John E. Anderson, of the University of Minnesota, retiring vice-president of Section I, on "Child Development and the Interpretation of Behavior," and by Professor Guy T. Buswell, University of Chicago, retiring vice-president of Section Q, on "Some Contributions of the Study of Eye Movements to the Psychology of Perception."

The Section on Social and Economic Sciences (K) will hold sessions on Tuesday afternoon, December 31, and on Wednesday and Thursday, January 1 and 2. On Tuesday afternoon papers will be given by Professor Stuart A. Queen, Washington University, St. Louis, on "An Ecological Study of St. Louis," and by Professor E. T. Hiller, of the University of Illinois, on "Regional Types and Trends; a Study of Ecological Organizations." The vice-presidential address will be given at 4:30 on Wednesday afternoon by Carl Snyder on "The Rule of Capitalism in Civilization." On Wednesday morning a paper will be read on "The Trends of the Decade in Social Work and Related Fields," by Dr. Fred S. Hall, editor of the Social Work Year Book, Russell Sage Foundation, New York City. This will be followed by a paper on "The Influence of the Cotton Program on the Southern Cropper, Tenant and Labor," by Fred C. Frey, dean of the College of Arts and Sciences, and head of the Department of Sociology, Louisiana State University, Baton Rouge. At the Thursday morning session Raymond D. Thomas, member of the Oklahoma Tax Commission, Oklahoma City, will present a paper on "The Economic Implications of Increased Taxation." Miss Leah Feder, assistant professor of social work at Washington University, St. Louis, will discuss "The Trend of Relief Administration During the Last Half

Century." The Thursday evening general session will be addressed by Dr. Harold G. Moulton, president of the Brookings Institution, Washington, D. C., who will speak on the subject "The Scientific Method in the Investigation of Economic Problems." Other sessions may be held on Tuesday and Friday mornings; joint sessions with the econometricists are planned for afternoons.

The Econometric Society will hold sessions on Thursday and Friday, January 2 and 3. The meetings on Thursday afternoon and evening will be devoted to symposia on the relation of building activity to business cycles. One program will consider financial aspects, on which papers will be given by Dr. Spurgeon Bell, director of the Statistics and Research Division of the Home Owners' Loan Bank Board, and by Alfred Cowles III, director of the Cowles Commission for Research in Economics. The effects of public building on economic conditions and the relations between farm and urban values will be discussed at another session, the speakers being Dr. Alexander Sachs, director of research for the Lehman Corporation, and Roy Wenzlick, director of Real Estate Analysts, Inc. A third program will be devoted to statistical analyses of factors influencing building activity, with papers by Dr. Charles F. Roos, of Colorado College, and W. H. Newman, of Chicago. Several authorities are expected to be added to the list of speakers. On Thursday morning there will be a joint session of the Econometric Society, the American Mathematical Society and the newly organized Institute of Mathematical Statistics, the program consisting of both invited and contributed papers on mathematical statistics and mathematical economics. One of the invited addresses will be given by Dr. Thomas H. Rawles, of Colorado College, who will discuss the mathematical theory of index numbers. The Econometric Society will hold another session on Friday, when Dr. Louis J. Paradiso and Victor S. von Szeliski, of the Review Division of NRA, will discuss statistical measurements of the effects of style, quality and price on retail purchases of shoes. Thursday noon there will be a luncheon of the society, followed by a short program, after which a business session will be held. Other meetings of the society will be held in New York on December 30 and 31, in conjunction with the meeting of the social science societies.

The Section on Historical and Philological Sciences (L) will hold joint sessions with the History of Science Society and the St. Louis Academy of Science on Thursday and Friday, January 2 and 3. On the first day there will be a symposium on "The Study and Teaching of the History of Science," led by Dr. George Sarton, of Harvard University. On the program will be Dr. Charles W. Morris, of the University of Chi-

ago, Dr. L. C. Karpinski, of the University of Michigan, Dr. H. T. Davis, of Indiana University, and Dr. Robert S. Woodbury, of the Massachusetts Institute of Technology. The second day will be devoted to the history of science in the St. Louis area, and the program being prepared will be of special interest to people living in and around St. Louis. It is anticipated that on the program will be Dr. Henry E. Sigerist, of Johns Hopkins University, Dr. Chauncey D. Leake, of the University of California, and Dr. C. A. Browne, president of the History of Science Society. The address of the retiring vice-president, Dr. Solon J. Buck, director of publications of The National Archives, will be on "The National Archives and the Advancement of Science."

The preliminary program for the meeting of the Section on Engineering Sciences (M) contemplates a symposium on Friday evening, January 3, at the rooms of the Engineers' Club, 4359 Lindell Boulevard, on the subject "Should the Engineering Profession Formulate a Philosophy of Social Welfare?"

The discussion will be opened by Dr. Karl T. Compton, president of the Massachusetts Institute of Technology as well as of the American Association for the Advancement of Science, who has agreed to give an explanation of the work of the Engineers' Council for Professional Development, with special reference to its relation to the subject of the evening. General Robert I. Rees, a member of the Executive Committee of the Council and vice-president of the American Telephone and Telegraph Company, will also participate, as will Dean D. S. Anderson, of Tulane University, president of the Society for the Promotion of Engineering Education. Dean A. S. Langsdorf, of Washington University, St. Louis, will present a brief paper on the general topic of the evening. Thereafter the meeting will be thrown open for general discussion.

The Section on Medical Sciences (N) will hold sessions for the reading of papers on the mornings of Monday, Tuesday, Wednesday, Thursday and Friday, December 30, through January 3; on Wednesday afternoon, January 1, at 4:30, Dr. Stanhope Bayne-Jones, vice-president and chairman of the section, will present an address dealing with "Bacterial Poisons and Their Antidotes." The sessions on Thursday and Friday will be devoted to symposia on the Sex Hormones. The isolation and chemistry of the estrogenic hormones will be discussed by Dr. E. A. Doisy, of St. Louis University. Dr. Marrian, of the University of Toronto, will take up the question of the excretion of combined oestrin during pregnancy. Certain clinical aspects of the use of ovarian substance will also be presented by Dr. Marrinus of Detroit. The hormonal control of menstruation will be the subject of a paper by Dr. G. W. Corner, of Rochester. This paper will

be followed by a discussion of the chemistry and physiological significance of progesterone by Dr. Willard Allen, also of Rochester. The clinical use of progesterone will then be discussed by Dr. Howard F. Kane, of George Washington University, in which impressive results with the use of this hormone in combatting habitual abortion will be presented. Another aspect of the female sex hormones, the lactogenic hormone, will be considered by Dr. C. W. Turner, of the University of Missouri. The session on Monday will be reserved for the presentation of a series of papers of varied nature. Among them are a paper by Dr. Laura A. Lane, of the University of Michigan, on an occupational study of cancer of the eye, and a discussion of yellow fever in the mosquito host, *Aedes aegypti*, by Dr. Cornelius B. Philip, of the U. S. Public Health Service. On Tuesday a joint session of the Section on Medical Sciences with the Subsection on Pharmacy will be held. Among the papers which will be presented by the Medical Sciences Section are two by Dr. T. Koppanyi, Dr. J. N. Dille and Dr. C. R. Linegar, of Georgetown University, on certain aspects of the peripheral action of barbiturates and a paper on the control of bronchial asthma by Dr. Noel F. Shambaugh of Los Angeles. In addition to these, Dr. Marvin Thompson, of the University of Maryland, has been invited by the Subsection on Pharmacy to present a paper on the pharmacology, therapeutics and chemistry of the new alkaloid of ergot which has received so much attention both in this country and abroad during recent months. A joint session with the Parasitologists will be held on Wednesday, the details of which will be reported under that heading.

The Subsection on Dentistry has arranged a program under the auspices of the American Division of the International Association for Dental Research, with the cooperation of the American Dental Association, the American Association of Dental Schools and the American College of Dentists. They will have an all-day meeting on Saturday, January 4. A dinner will precede the evening session. Papers on diseases of the mouth, stressing caries, will present the results of recent researches. Dental exhibits will be shown in conjunction with the general scientific exhibits, in the Exhibit Hall of the Auditorium, from Tuesday to Friday.

In addition to the joint session noted, the Subsection on Pharmacy will hold a meeting on Tuesday afternoon. Among the papers presented at that time is one on cortin by Dr. Arthur Grollman, of Johns Hopkins University, and one by Dr. John C. Krantz, Jr., of the University of Maryland, on the effect of chlorinating ethylenes on the perfused leg vessels of the frog.

The Section on Agriculture (O), in conjunction



with the American Society of Agronomy, has arranged a symposium for Tuesday morning, December 31, on the subject "The Conservation of the Land." This will be of large general interest to all members of the association as well as to section members, as the subject is a very live and popular one at the present time and one which is extremely important, since conservation is directly involved in much of the emergency work of the national government and is an integral part of all land-use planning studies. The program will open with the address of the retiring vice-president of the association and chairman of the section, Dr. Jacob G. Lipman, of New Jersey, whose subject is "The Conservation of Our Land Resources." He will discuss the broad aspects of conservation and its importance to agriculture and to the future security of the nation. The remaining addresses will center around the conservation problems and the general program of erosion control in the Mid-West and the Far-West range country. Dr. C. R. Enlow, well-known plant authority, will discuss "Regrassing Semi-Arid Plains." Dean L. E. Call, of Kansas, will present the results of "Cultural Methods of Controlling Wind Erosion," summarizing the work which has been done to prevent the recurrence of the disastrous dust storms of last year. Dr. George Stewart, of the Forest Service in Utah, will discuss the problem of "Range Management in Relation to Erosion Control," emphasizing the importance of erosion control in the range country and presenting the results of research work which has been carried out along this line. A discussion will follow each address. On Thursday morning, January 2, there will be a joint round-table conference with the Genetics Society of America on the subject "Genetics and Plant Breeding." Vice-president H. K. Hayes will represent the section and also the American Society of Agronomy as a leader in this conference.

The American Society for Horticultural Science will meet on December 31 and January 1 and 2. There will be a joint meeting with the Potato Association of America on Tuesday afternoon; one with the American Society of Plant Physiologists on Wednesday morning, the program being devoted to physiological problems of horticultural plants; and a joint session with the Genetics Society on Thursday morning. The banquet will be held on Wednesday evening, at which time the president of the society, Director H. H. Zimmerley, of Norfolk, Va., will give his address.

The Potato Association of America plans joint sessions with other organizations as follows: (1) with the American Society for Horticultural Science on Tuesday afternoon; (2) with the American Phytopathological Society on Thursday afternoon. The Wednesday morning program will be devoted to a considera-

tion of seed potato certification and the Wednesday afternoon session to a discussion of new developments in potato breeding. Among those who will take part in this program are F. J. Stevenson, E. S. Schultz, C. F. Clark, W. P. Raleigh, Reiner Bonde, F. A. Krantz, H. C. Moore, A. F. Yeager, N. E. Gardner, J. C. Miller, A. T. Erwin and J. G. Leach. Other subjects to be discussed include potato scab and rhizoctonia, spraying, irrigation, marketing and control measures. These subjects will be discussed by leaders in the various fields.

The Section on Education (Q) plans three sectional meetings, two joint programs with the Section on Psychology and one with the Section on Chemistry. A sectional program has been planned for Monday morning, December 30, based on studies in personality, its nature, genesis, organization and measurement. The afternoon program will relate to studies of learning in reading and arithmetic. On Tuesday morning the sectional program will consist primarily of reports of studies from field members. A joint program has been planned with the Section on Psychology for Tuesday afternoon on "Maturation and Learning." Papers will be presented by Dr. E. L. Thorndike, of Columbia University, Dr. Leonard Carmichael, of Brown University, and Dr. Calvin P. Stone, of Stanford University. At the annual luncheon to be held jointly with the Section on Psychology on Tuesday noon the retiring vice-presidents of the two sections will give addresses. On Wednesday morning will be held a joint session with the Section on Chemistry, with the cooperation of the Division of Chemical Education of the American Chemical Society.

The Society of the Sigma Xi will hold its thirty-sixth annual convention on Tuesday, December 31. The executive committee of the society will meet at 2:00 o'clock in the Hotel Jefferson. The business session will convene at 4:00 o'clock, a buffet supper will follow and the fourteenth annual lecture, given under the joint auspices of the association and the society, will be delivered in the evening by John Bellamy Taylor, of the General Electric Company, on the topic "The Electric Eye and the Human Eye."

The United Chapters of Phi Beta Kappa is sponsoring the first of a series of annual lectures emphasizing the cultural aspects of science on Wednesday evening, January 1. Dr. Frederick J. E. Woodbridge, Johnsonian professor of philosophy at Columbia University, editor of *The Journal of Philosophy*, and a member of the editorial board of *The American Scholar*, will inaugurate this series with an address entitled "The Claims of Science." This meeting will be open to the general public and all local Phi Beta Kappa members will be specially invited to attend. Throughout the entire five days of the meeting there will be an

exhibit of *The American Scholar*, laying particular stress upon the quarterly's participation in interpreting to laymen developments in the various scientific fields. This exhibit will be a division of the general exhibit of the association.

The American Association of University Professors will hold its twenty-second annual meeting in connection with the meetings of the American Association for the Advancement of Science at St. Louis on Monday and Tuesday, December 30 and 31. Among the annual reports to be presented are those of the Committee on Academic Freedom and Tenure, Professor Carl Wittke, of Ohio State University, *chairman*; the

Committee on Pensions and Insurance, Professor E. W. Patterson, of Columbia University, *chairman*; and the Committee on Place and Function of Faculties in University and College Government, Professor G. H. Sabine, of Cornell University, *chairman*. A special report will be submitted by the new Committee on the Effect of Depression and Recovery on Higher Education. The usual formal dinner will be omitted in order that members may attend the general session on Monday evening. At the regular luncheon on Tuesday formal addresses will be given, including that of the retiring president, Professor S. A. Mitchell, of the University of Virginia.

## OBITUARY

### JOSEPH PETERSON

DR. JOSEPH PETERSON, professor of psychology at the George Peabody College for Teachers, Nashville, Tennessee, died on September 20, at the age of fifty-seven years. Less than two weeks before that date, at Ann Arbor, Michigan, he presided as a past-president of the American Psychological Association at one of its official convocations. He was stricken with pneumonia while visiting his son in California.

Dr. Peterson attended the University of Chicago, where he received the A.B. degree in 1905, was a fellow for two years (1905-1907) and received the Ph.D. in 1907.

He spent five years in public school work before entering college. At the conclusion of his academic training he served as professor of psychology at Brigham Young University, the University of Utah, the University of Minnesota, where he was chairman of the department for one year, and the George Peabody College for Teachers, where he had been professor since 1918.

Dr. Peterson was one of the ablest and most active members of his institution and aided materially in making it an important educational influence in the southern states.

In 1925, in collaboration with the president of his college, he made a survey of the equipment of teacher-training institutions of the South for giving training in psychology and educational psychology. The conditions disclosed were generally considered to be so deplorable that the Southern Society for Philosophy and Psychology appointed a committee, with Dr. Peterson as chairman, to take some effective action. He was largely responsible for the setting of standards of efficiency of teachers and students that have had a decidedly beneficial influence upon the universities, teachers' colleges and training schools throughout the South.

Although burdened with a heavy load of teaching and administrative work, he was a tireless investigator in the field of psychology and published many important scientific papers, particularly in the field of race differences, measuring techniques and learning. His work on race differences was characterized by an open-mindedness and balance of judgment greatly needed but so frequently lacking in studies of this question. In learning he was particularly concerned with its mechanisms and did much to clarify our thinking about it. His contributions to the techniques of measurement were more varied and less systematic, but were no less valuable on that account.

In addition to his other responsibilities, he was always ready and willing to carry his share of editorial and other activities for the good of his science. He was an associate editor of the *Peabody Journal of Education*, of the *Mental Measurement Monographs* and of the *American Journal of Psychology*. For this publication he built up a department of book reviews that constitutes a very real asset to scientific workers in psychology. In 1935 he became editor of the *Psychological Monographs*, succeeding the late Shepard Ivory Franz.

From 1926 to 1929 he was a member of the division of anthropology and psychology of the National Research Council, and in 1932 he served on its committee on fellowships.

All these varied activities took heavy toll of the time and energy of one who never seemed to be robust. He lived on an enthusiasm for his work, a devotion to his colleagues and a genuine love of science that have been an inspiration to all those who have come into contact with him.

A. T. POFFENBERGER

### RECENT DEATHS

CHARLES LESLIE FLEECE, head of the department of chemistry, Central College, Fayette, Mo., died on



November 13. Dr. Fleece graduated from Centre College, Kentucky, in 1910 and received his doctorate from Princeton University in 1926. He taught at Princeton for sixteen years before accepting the chair of chemistry at Central College.

A CORRESPONDENT writes: "I have just had word from Leningrad that Dr. Vs. T. Pavlov, eldest son of Professor I. P. Pavlov, died on the 29th of October from an inoperable carcinoma of the pancreas. Dr.

Pavlov for many years has travelled with his father during his attendance at congresses, and all those who were members of the fifteenth International Physiological Congress in the U. S. S. R. last summer will remember how much Pavlov did for their comfort and pleasure. He entertained various members of the congress almost every night and with his extraordinary linguistic powers no one could have been a more gracious or more interesting host."

## SCIENTIFIC EVENTS

### THE SIMPLIFICATION OF INTERNATIONAL WEATHER REPORTS

W. R. GREGG, chief of the U. S. Weather Bureau, who has returned to Washington after attending the eighth meeting of the International Meteorological Organization in Warsaw, reports that representatives of forty-two countries adopted a program for further unification of the codes, symbols and units employed in the international exchange of weather reports. Although great progress along these lines has been made in the last fifteen years, many loose ends are said to remain.

Confusion from differences in speech is avoided in international weather codes by using figures, rather than words. These figure codes are now very generally used by ships reporting from sea. Land stations, however, have lagged behind in substituting new for old codes. Now the maps on which daily weather forecasts are based will look alike the world over as soon as the international symbols adopted by the conference are universally accepted. A black dot will mean light rain or drizzle, a star will mean light snow, and a plain circle will mean clear, cloudless skies.

Mr. Gregg points out that differences in national systems of weights and measures make complete uniformity in the units for weather reports very difficult. For example, before reports can go out over the Arlington wireless towers near Washington, D. C., inches, used to measure atmospheric pressure in this country, must be converted into millibars; miles per hour, used to express wind velocity here, must be converted into the Beaufort scale of wind force, and so on. All European countries, except Great Britain, translate into degrees Centigrade the temperature reports received in degrees Fahrenheit from the United States.

European meteorologists are working on many of the problems that are not receiving special attention in America—notably, how to record conditions in the upper air more accurately. Russian meteorologists have perfected an instrument that is proving very effective. Carried aloft by a balloon, this instrument,

by means of a radio attachment, sends back signals that give observers on the ground a true record of temperatures, pressures and wind velocities at the different levels of the atmosphere up to several thousand feet.

European forecasters, like American forecasters, are developing air mass analysis as a valuable supplement to observations taken at the earth's surface, but not as a substitute for them.

### EXPEDITION TO MAUNA KEA OF THE HAWAIIAN ACADEMY OF SCIENCE

THE Hawaiian Academy of Science has completed a successful two-weeks expedition to the summit of Mauna Kea, 13,784 feet, and the highest peak on any Pacific island. The summit camp was established at Lake Waiau, in the bowl of a cinder cone, at 13,007 feet, where water is available and which is partially sheltered from the wind. The chief purpose was to permit geologists, botanists, entomologists and various other naturalists to work from a semi-permanent camp and study the features of the zone above 10,000 feet which has heretofore been studied only in the most casual way during hurried one-day trips to the summit and return. There is no forage for animals and no wood within 3,500 feet of the summit.

Successful establishment of the summit camp was largely due to the cordial and full cooperation of the U. S. Army, Hawaiian Department, from which nine enlisted men, in charge of Lieut. H. A. Meyer, were detailed to take charge of transport and maintenance operations. Pack mules and packers were furnished by the courtesy of the local C.C.C. unit and various facilities and housing were made available at the base camp Humuula, at 6,700 feet in the saddle between Mauna Kea and Mauna Loa, by Alfred Carter, trustee of the Parker ranch. The advance party was transported to the island of Hawaii from Honolulu on the Coast Guard cutter *Itasca*, through the courtesy of Commander W. N. Derby.

At the summit all recorded air temperatures were below 60 degrees, and minimum temperatures aver-

aged about 26 degrees with 19 degrees recorded one night. Water froze every night and the rarified air offered difficulties to a party coming up abruptly from sea level. Many interesting features were encountered, including especially abundant evidences of Pleistocene glaciation, previously known but not before studied at all in detail. There were also evidences of severe modern frost action and rock fragments and soils displayed chiefly the light gray colors characteristic of cold climate weathering.

The time of the fourteen scientific members of the party was divided variously between the base and summit camps according to features studied.

### PROPOSED NEW BUILDINGS FOR THE NATIONAL ZOOLOGICAL PARK

THE National Zoological Park at Washington, under a \$680,000 PWA grant, according to *The Museum News*, is planning to erect a series of new structures from plans prepared under the direction of Edwin H. Clarke, supervising architect. Bids have been asked for the building of a new wing for the bird house, and plans for three other buildings have been completed.

In the new bird house wing a new interior treatment is to be used. The cages will have glass fronts and direct lighting from above. A movable skylight will make it possible for the birds to have fresh air and sunlight during warm weather. At either end there will be a panorama cage—one a tropical aviary and the other an artificially chilled air-conditioned room for birds of the colder climates. This new wing will complete the bird house.

A new exhibition building will contain quarters for all the great apes and for a large number of small mammals. American and exotic rodents will be exhibited in a special room under more or less natural conditions and in full view of the public.

A modern building will be erected to house elephants, rhinoceri, hippopotami and tapirs, with a large cage at one end for giraffe. Moats will be used for the outside inclosures instead of bars.

A power plant, machine shop and carpenter shop will be erected in place of the present inadequate quarters. In addition to functioning as power plant and central heating plant, these structures will house the mechanical departments and equipment for maintenance of the park and of Rock Creek Park.

### ADVISORY COUNCIL ON APPLIED PHYSICS OF THE INSTITUTE OF PHYSICS

THE Advisory Council on Applied Physics of the institute met at the University Club, Pittsburgh, Pa., on November 16. This was the inaugural meeting of this council, whose purpose is to stimulate the application of physics by recommending suitable actions and policies to the institute and the founder societies. According to a statement sent us by Dr. Henry A. Barton, secretary of the institute, Dr. Paul D. Foote, executive vice-president of the Gulf Research and Development Corporation, presided during the morning session and Dr. Lyman J. Briggs, director of the Bureau of Standards, during the afternoon. The meeting was devoted, for the most part, to informal discussion. This was started by Professor G. B. Pegram, of Columbia University, who described briefly the events leading up to formation of the council, including the inauguration of the institute with such aims partially in view and a preliminary conference called last December by the institute jointly with the National Research Council.

Discussion followed on the university education and training of men whose careers are to lie in industrial research. This discussion was opened with reports by Dr. Saul Dushman (presented by Dr. A. W. Hull), of the General Electric Company, and Professor George R. Harrison, of the Massachusetts Institute of Technology.

Further discussion was devoted to the services which are rendered by the founder societies and the institute to physicists employed in industrial laboratories. Reports on this topic were presented by Dr. L. O. Grondahl, director of research, Union Switch and Signal Company, and Professor John T. Tate, University of Minnesota. In this connection the council passed a resolution encouraging formations by such physicists of a division on applied physics of the Physical Society. It was strongly felt that, while the Optical Society, the Acoustical Society and the Society of Rheology furnish facilities for meetings and publications in their fields, other general applications of physics were neglected. The opinion of the council was opposed to the formation of new specialized societies since only through close integration with the Physical Society could the community of interest and interchange of ideas between the general applications and the basic fundamentals of physics be conserved.

## SCIENTIFIC NOTES AND NEWS

DR. G. A. YOUNG, chief geologist of the Canadian Geological Survey, has been elected president of the Royal Society of Canada. The presidency has been vacant since the death last summer in an airplane

crash of Dr. Reginald W. Brock, dean of the University of British Columbia.

THE Harrison Memorial Medal of the Pharmaceutical Society of Great Britain was presented to Pro-



Professor Arthur Smithells, director of the Salters' Institute of Industrial Chemistry, on November 12. On this occasion he delivered the Harrison Memorial Lecture, taking as his subject "The Teaching of Chemistry."

PROFESSOR PIERRE MASSON, head of the department of pathology of the University of Montreal, formerly professor of pathology at the University of Strasbourg, has been elected a member of the Academy of Medicine, Paris.

THE Rensselaer Polytechnic Institute Chapter of the Society of the Sigma Xi has elected to membership Dr. Rudolf Ruedemann, of Albany, New York State paleontologist.

DR. W. S. BLATCHLEY, from 1894 to 1911 state geologist of Indiana, was elected to honorary fellowship in the Indiana Academy of Science at its recent annual meeting.

SIR D'ARCY POWER, of London, the distinguished surgeon and medical historian, celebrated his eightieth birthday on November 11. Sir D'Arcy was visiting professor at the Johns Hopkins University in 1930-1931.

DR. HAROLD C. UREY, professor of chemistry at Columbia University and winner of the Nobel Prize in chemistry for his discovery of heavy water, has been awarded the first bronze Columbia lion by the affiliated Columbia University Alumni Clubs of Northern New Jersey. The prize, which was instituted last year, is awarded to "an outstanding citizen of New Jersey who has brought honor to Columbia University through conspicuous world service and noteworthy achievement." The medal will be presented at a reunion to be held on December 4 at the Newark Athletic Club.

THE Associate Alumni of the College of the City of New York, at their annual dinner in New York City on November 16, presented five Townsend Harris medals to alumni in honor of their achievements and services to the college. The medals included an award to Dr. Lorande Loss Woodruff, professor of zoology at Yale University. The citation was: "Lorande Loss Woodruff, '00—Teacher in the venerable University of Yale, zoologist of national eminence, painstaking scholar in a basic field of biology, contributor to the learned periodicals in your own and allied subjects, member of the National Academy of Sciences, you have manifested that disinterested love of learning toward the attainment of which all true centers of advanced study constantly strive. You have taken to another campus the tradition that has given vitality to the academic life of your college. In you Alma Mater finds particular reason to rejoice."

A DINNER in honor of Dr. Isaiah Bowman, president of the Johns Hopkins University, was given in Baltimore on November 16, by the Hopkins Chapters of Phi Delta Kappa and Pi Lambda Theta. The guests included Dr. John W. Studebaker, U. S. Commissioner of Education; Raymond S. Williams, president of the Baltimore School Board; Miss Bess Goodykoontz, assistant commissioner of education and president of Pi Lambda Theta, and Mrs. William Bauernschmidt, executive secretary of the Public School Association. Dr. Florence E. Bamberger, professor of education in the Johns Hopkins University, presided, and Dr. David E. Weglein, superintendent of the Baltimore schools, acted as toastmaster.

THE Iowa State College Chapter of Sigma Xi on October 31 entertained at dinner Dr. E. C. Kendall, head of the chemical section of the Mayo Foundation, Rochester, Minn. On this occasion he delivered an address entitled "Chemical and Physiologic Studies of the Suprarenal Cortex."

A PRIZE of \$3,000 offered in 1933 by the Eugenics Research Association for original research on the "probability of commitment for a mental disorder of any kind, based on the individual's family history" has been awarded to Dr. Serge Androp, of the staff of the Ohio Hospital for Epileptics at Gallipolis.

OFFICERS of the Chemical Society of Washington were elected at the annual meeting on November 14 as follows: *President*, J. H. Hibben, Geophysical Laboratory, Carnegie Institution of Washington; *Secretary*, K. S. Markley, Food Research Division, the Bureau of Chemistry and Soils; *Treasurer*, H. L. Haller, Bureau of Entomology and Plant Quarantine, and Dr. James F. Couch, the retiring president, was elected a member of the council. After the election Dr. Hugh S. Taylor, professor of chemistry and chairman of the department of chemistry at Princeton University, addressed the society on "Modern Developments in Surface Catalysis."

THE annual meeting of the Indiana Academy of Science was held on November 8 and 9 at Wabash College, Crawfordsville, Ind., under the presidency of Dr. Will Scott. New officers elected at this meeting are: *President*, R. C. Friesner, Butler University; *Vice-president*, Edward Kintner, North Manchester College; *Secretary*, L. A. Test, Purdue University; *Treasurer*, Will Morgan, Indiana Central College; *Editor*, Paul Weatherwax, Indiana University, and *Press Secretary*, T. R. Johnston, Purdue University.

CHARLES K. GRAEBER, of the Pennsylvania Topographic and Geologic Survey, has been elected permanent secretary-treasurer of the Field Conference of Pennsylvania Geologists. Mr. Graeber succeeds Dr.

Bradford Willard, who recently resigned after holding the office since the organization of the conference in 1931.

DR. N. M. JOSEPHUS JITTA has succeeded Sir George Seaton Buchanan as president of the International Office of Public Hygiene.

DR. CHARLES W. HUGHES, assistant in anatomy at Loyola University School of Medicine, Chicago, has been appointed associate professor of anatomy, succeeding Dr. Simon B. Chandler.

DR. REUBEN E. TRIPPENSEE has been appointed to the newly established chair of wildlife management at the Massachusetts State College at Amherst.

R. L. GARNER has resigned his position as chemist for the biological division of the Johns Hopkins Hospital and has become instructor in the department of biological chemistry of the Medical School of the University of Michigan.

THE council of the University of Liverpool, on the recommendation of the senate, has conferred the title of "professor emeritus" on Professor L. R. Wilberforce and Professor W. H. Gilmour, who retired at the end of last session. Professor Wilberforce was appointed to the Lyon Jones chair of physics in 1900, and Professor Gilmour to the Louis Cohen chair of dental surgery on its foundation in 1920.

*Nature* states that the Mackinnon research studentship of the Royal Society has been awarded to Dr. G. W. Brindley, assistant lecturer in physics in the University of Leeds, for his research on x-ray reflections from metals in relation to atomic vibrations.

DR. MAX PINNER has recently resigned his position as associate director, in charge of the laboratories of the Desert Sanatorium, Tucson, Ariz., in order to accept an appointment by the New York State Department of Health as principal diagnostic pathologist in charge of the laboratories of the three New York State Tuberculosis Hospitals in Mount Morris, Ithaca and Oneonta. From November 1 on Dr. Pinner's headquarters will be at Oneonta until the Herman Biggs Memorial Hospital at Ithaca is completed.

DR. C. N. MCBRYDE, director of the field station of the U. S. Bureau of Animal Industry of the U. S. Department of Agriculture at Ames, Iowa, has declined an offer to become chief of the Biochemic Division of the bureau at Washington, D. C., to succeed the late Dr. Marion Dorset, who died in July.

PROFESSOR A. O. LEUSCHNER, of the University of California at Berkeley, has accepted the chairmanship of Committee R of the American Association of University Professors on Encouragement of University Research.

*The Museum News* reports that Edward C. Blum, president of the Brooklyn Institute of Arts and Sciences; George Blumenthal, president of the Metropolitan Museum of Art, and F. Trubee Davison, president of the American Museum of Natural History, were among the signers of the articles of incorporation of the "New York World's Fair, 1939," filed at Albany on October 23.

PROFESSOR BJORN HELLAND-HANSEN, director of the Geophysical Institute at Bergen, Norway, was a recent visitor to the Scripps Institution of Oceanography. While there he gave a public lecture on "Nansen, the Explorer and Oceanographer." He also conducted two seminars in oceanography and held conferences with members of the staff engaged in the study of physical and chemical oceanography.

PROFESSOR HARLOW SHAPLEY, director of the Harvard College Observatory, spoke on November 16 before the Royal Canadian Institute.

THE third Harvey Society lecture will be given at the New York Academy of Medicine, New York City, on December 5 at 8:30 P. M., by Dr. Peyton Rous, member of the Rockefeller Institute for Medical Research, on "The Virus Tumors and the Tumor Problem."

DR. BERT CUNNINGHAM, professor of biology at Duke University, will speak on December 4 on phases of "The Endocrine System" to students of Winthrop College. He will also be the guest speaker before the college chapter of Beta Beta Beta.

A PUBLIC meeting of the Columbia University Chapter of Sigma Xi will be held in Schermerhorn Hall at 8 P. M. on December 9. Major Edwin H. Armstrong, professor of electrical engineering, will discuss "New Vistas in Radio Signaling." The speaker will demonstrate experimentally his latest discoveries of the use of a new system of frequency modulation which makes possible broadcasting without static or other forms of disturbance.

THE International Union of Geodesy and Geophysics will meet at the University of Edinburgh from September 15 to 26, 1936.

THE date of the third International Congress on Malaria has been postponed until the spring of 1936. Further information can be obtained from the president, Professor G. Pittaluga, director of the National Institute of Health, Calle de Recoletos 20, Madrid.

THE annual meeting and dinner of the New York Academy of Sciences and Affiliated Societies will be held on Monday, December 16, at 7 P. M. at the American Museum of Natural History. The program will include an address by Dr. Marshall A. Howe, retiring



president of the academy, entitled "Plants That Form Reefs and Islands," with a series of botanical motion pictures.

At a special meeting held on November 16 the Division of Medical Sciences of the National Research Council made the following grants: Alvan L. Barach, associate in medicine, Columbia College of Physicians and Surgeons, "the therapeutic use of helium"; E. V. Cowdry, professor of cytology, Washington University School of Medicine, "the effect of treatment with activated ergosterol on the kidneys, parathyroids and other tissues"; Magnus I. Gregersen, professor of physiology, University of Maryland School of Medicine, "plasma volume changes"; Orthello R. Langworthy, associate professor of neurology, the Johns Hopkins University Medical School, "studies of the urinary bladder." The next regular meeting of the Committee on Grants-in-Aid for the consideration of applications for grants in all the natural sciences will be held in March. Applications must be on file with the secretary of the committee, Dr. Clarence J. West, not later than February 15, 1936. Further information and application blanks will be furnished on request.

PREVIOUS awards from the Elizabeth Thompson Science Fund were reported in SCIENCE on November 2, 1934, and earlier. Since the last report the following awards have been made. At the meeting of December 5, \$125 was awarded to Christianna Smith, Mount Holyoke College, for the investigation of rat blood at time of birth; \$150 to Phineas W. Whiting, Carnegie Institution of Washington, for an investigation of the difference between the x and y chromosomes; and \$250 to Dorothy Wolff, Washington University School of Medicine, for the study of neurone patterns in the human spinal ganglion of cochlea. At the meeting of April 17, the loan of a grinding machine and \$60 for its repair and alteration were awarded to Alfred S. Romer, Harvard University, to be used in making serial sections of fossil fish and reptile skulls. The trustees of the fund are as follows: Walter B. Cannon, *president*; Jeffries Wyman, Jr., *secretary*; Charles B. Curtis, Jr., *treasurer*; G. P. Baxter, J. C. Slater, A. C. Redfield, *trustees*. The next meeting will be held in April, 1936, and applications for grants should be made to the secretary, Biological Laboratories, Harvard University, Cambridge, Mass.

THE Drexel Institute at Philadelphia has received the residuary estate of the late Lillie Bell Randell, amounting with principal and interest to a little more than \$425,000. The will has been delayed for several years in distribution by the difficulty of determining the legal residence of the testatrix.

A NEW plant hormone laboratory and greenhouse

have been completed for the department of botany at Connecticut College, at a cost of \$22,000. The hormone laboratory and two research compartments of the greenhouse are the gift of the Rockefeller Foundation; the compartments for teaching and exhibition purposes are the joint gift of A. C. Ernst, of Cleveland, E. J. Block, of Chicago, Charles E. White and George Whittlesey, of New London. The plant hormone laboratories are underground, and completely air conditioned; special provision has been made for quantitative studies on the influence of monochromatic light on phytohormones and the structural phases of the development of organisms.

At a luncheon in Washington on November 19, President Roosevelt entertained members of the Commission for Infantile Paralysis Research. Receipts of \$1,071,000 from the series of balls held on President Roosevelt's birthday anniversary last January were announced. Seventy per cent. of the total receipts had been turned back to the communities where the funds were raised for the support of local work. The remaining 30 per cent. brought the committee's share of the money to \$326,062, of which \$19,180 additional was returned to communities. No receipts were given to the Warm Springs Foundation. After all expenses were paid \$241,000 was turned over to the research commission, which has allocated \$110,000 in grants as follows: Harvard University, Dr. W. Lloyd Aycock; Long Island College of Medicine, Dr. Sidney D. Kramer; New York University, Dr. William H. Park; University of Chicago, Dr. Paul H. Harmon; University of Pennsylvania, Dr. Joseph Stokes, Jr.; Stanford University, Professor E. W. Schultz; University of California, George Williams Hooper Foundation, Dr. Karl F. Meyer; University of Southern California, Dr. John F. Kessel; Western Reserve University, Dr. John A. Toomey, and Yale University, Dr. John R. Paul and Dr. James D. Trask.

It is stated in *Nature* that a scheme has been prepared for the establishment in Colombo, Ceylon, of a fisheries research station combined with an aquarium which is under consideration. This provides in the first instance for a small biological research station capable of being enlarged as funds are available. It will be equipped with research laboratories and fresh-water and marine aquaria essential for fisheries investigation work. An aquarium will be attached to which the public will be admitted. The field of research will include investigations into life-histories and general bionomics of all aquatic animals of importance in Ceylon, into the culture of pearl and edible oysters, into the farming of estuaries and fresh-water fishes and turtle, and into the importance of various indigenous larvivorous fishes in relation to the suppression of tropical fevers and the breeding and distributing of the most active forms throughout Ceylon.

## DISCUSSION

COSMIC AND GOVERNMENTAL  
PHENOMENA

ON the basis of radio communication reports submitted to the Bureau of Standards, Dr. J. H. Dellinger<sup>1</sup> has recently announced a "cosmic phenomenon" which caused brief interruptions of long-distance, short-wave communications on four occasions in 1935. Such interruptions were effective over the entire illuminated half of the globe and were spaced approximately 54 days apart (twice the period of rotation of the central portion of the sun).

In 1933 we were fortunate enough to secure complete records of radio echoes reflected from the ionosphere during extremely turbulent periods associated with three successive minor magnetic storms, and it appears quite certain that the observed turbulence is sufficient to produce effects similar to those described by Dr. Dellinger. Magnetic storms have been known to recur, after approximate 27-day intervals, on as many as eight successive occasions.<sup>2</sup> A diagram published in one of our previous reports<sup>3</sup> gives an indication of the sudden and violent changes in radio echo patterns which commonly occur at such times.

On checking over the original photographic records, it is apparent that they agree very well indeed with the recent reports of communication interruption. The most violent echo disturbances last only a few minutes. They are preceded and followed by subsidiary changes which prolong the individual abnormal periods to about 15 minutes. At the peak of the disturbance transmission conditions are changing so rapidly that it is difficult to imagine that any long-distance short-wave communication *could* be successful, though the service interruptions might be so brief that they would escape casual observation. The abnormalities were noted while the observing station was on the illuminated side of the earth.

During the 1933 sequence the main disturbances occurred as follows:

Feb. 19, 9: 10-9: 15 A.M., E.S.T. (with a minor turbulence at 10: 35 A.M.).

Mar. 19, 3: 45-3: 50 P.M., E.S.T. (with a minor turbulence at 11: 35 A.M.).

Apr. 15, 1: 32-1: 40 P.M., E.S.T. (with a minor turbulence at 12: 10 P.M.).

Like other solar phenomena, the sequence is approximately periodic, but successive intervals may differ in length by about one day. Minor disturbances often appear on days preceding and following the main event, but the period of greatest agitation is well

<sup>1</sup> J. H. Dellinger, *SCIENCE*, October 11, 1935.

<sup>2</sup> G. Angenheister and J. Bartels, *Handbuch der Experimental Physik* (Wien-Harms), Vol. 25, part 1, p. 674, 1928.

<sup>3</sup> H. R. Mimno and P. H. Wang, *Phys. Rev.*, 43: 769, 1933.

marked. On the third occasion we awaited the event with considerable confidence and were able to obtain the "fine structure" of the echo pattern by means of an auxiliary high-speed photographic recorder which was prepared in advance and set in operation before the commencement of the violent phase.

Until the apparent double period of 54 days, indicated by Dr. Dellinger's 1935 communication records, is further substantiated, we prefer to consider that it is somewhat fortuitous and that brief intervening disturbances at the 27-day points may have escaped observation. It would seem that this might easily occur if the most active or most susceptible radio channels happened to lie on the dark side of the earth at the crucial moment, or if the event happened at an hour when communication traffic was relatively slack. In any case, it is probable that the 1935 "storm" has lasted about as long as it is likely to endure, and that further extensions of the existing sequence of dates need not be expected.

Unfortunately no continuous automatic records could be obtained during the 1935 period covered by Dr. Dellinger's report. During the past 16 months the Federal Communications Commission has repeatedly postponed the rephrasing of certain obsolete regulations, limiting the use of automatic apparatus, which effectively block the continuation of fundamental research. The commission freely admits that the ancient clause in the regulations has no engineering justification whatever when extended to our new experiments and has therefore repeatedly promised remedial action. Already an important part of the sunspot cycle has been completely lost, by governmental decree.

HARRY ROWE MIMNO

CRUFT LABORATORY  
HARVARD UNIVERSITY

THE EPICENTER OF THE HELENA,  
MONTANA, EARTHQUAKE

EARTHQUAKE shocks of a destructive nature, the epicenters of which are about two miles north of Helena, Montana, occurred on October 12, 18 and 31. Geological field investigations initiated by the Montana Bureau of Mines and Geology immediately following each of the shocks established the epicenter on the southern side of Helena Valley (Prickly Pear Valley on some maps). This determination has been verified by excellent seismograph records obtained by Franklin P. Ulrich and Dr. D. S. Carder, of the Coast and Geodetic Survey, from the strong shock on October 31 and numerous minor shocks since October 19.

The earthquakes were caused by a northwest trending fault, but because of the deep cover of gravel and sand in the Helena Valley it is impossible to see the



fault plane. The fault zone extends for a distance of approximately 14 miles, from a point a mile or more to the northwest of Helena to an indefinite point between East Helena and Clasoil. The fault is probably of the normal type, and is part of the late Tertiary diastrophism. The zone of slipping is near the northern border of the Boulder Batholith.

According to the Rossi-Forel scale the intensity of the three more important shocks was determined as 8, 9 and 9 minus, respectively. The greatest damage occurred on October 18 at 9:47 P. M. This shock was felt over an area of about 200,000 square miles. At that time two lives were lost and property damage was estimated at about \$3,000,000 in Helena and East Helena. Few buildings were completely destroyed, but many partially ruined. Many structures were so severely weakened by the shocks on October 12 and 18 that the shock on the 31st caused numerous buildings to collapse.

The after-shocks are still in progress and some are of great enough intensity to be felt 75 miles distant. The stronger after-shocks are severe enough to cause loose plaster and bricks to fall. To date more than 900 minor shocks have been recorded by W. E. Maughan, Federal Metrologist, at the Helena Weather Bureau.

HAROLD W. SCOTT

MONTANA SCHOOL OF MINES,  
BUTTE, MONTANA

## ON THE HISTORY OF NEGATIVE NUMBERS

THE history of the negative numbers has recently been extended backwards more than a thousand years by the discovery of the fact that the ancient Babylonians used such numbers occasionally in their statements relating to algebraic equations. It has commonly been assumed that the ancient Hindus were the first to employ actually negative numbers but that the ancient Greeks operated somewhat earlier with binomials of the form  $a - b$ , where  $a$  and  $b$  are positive numbers and  $a > b$ . In this connection Diophantus, in the second half of the third century A.D., stated that a subtracted number multiplied by a subtracted number gives an added number and that a subtracted number multiplied by an added number gives a subtracted number. These "rules" were later observed to apply to actually negative numbers as well as to subtracted numbers when the minuend is larger than the subtrahend, as was always assumed by Diophantus and by the other Greek writers.

Recently O. Neugebauer, who was formerly at Göttingen, Germany, but is now at Copenhagen, Denmark, published a volume in two parts under the title "Mathematische Keilschrift-Texte," which appeared as volume 3, Abteilung A, of the well-known periodical entitled *Quellen und Studien zur Geschichte der Mathe-*

*matik, Astronomie und Physik*, which was started in 1930 and appears irregularly. On page 387 of the first part of this volume he calls attention to the fact that the second member of the ancient Babylonian equations was sometimes a negative number while at other times it was either positive or zero. On page 463 he gives an example of an equation of the former type and emphasizes the fact that it follows from the language that the writer was fully aware that he was dealing with a negative number as a second member of this equation.

The use of a negative number alone as a member of an equation is a noteworthy fact in the history of negative numbers but it should be emphasized that it does not imply that the ancient Babylonians understood negative numbers in the modern sense of this term. Such an insight does not seem to have been attained before about the beginning of the nineteenth century. In very ancient times the Babylonians had a special symbol, called *lal*, which corresponds to our minus sign, so that  $a \text{ lal } b$  corresponds to our  $a - b$ , where  $a$  and  $b$  are positive and  $a$  exceeds  $b$ , but there is a considerable step from this use to the use of a negative number standing alone as a member of an equation. It is this step which is emphasized here, but beyond this there is a much longer step leading to the establishment of the legitimate use of negative numbers in the various elementary operations. The latter step presented the greatest difficulties and does not seem to have been undertaken by either the ancient or the medieval mathematicians.

G. A. MILLER

UNIVERSITY OF ILLINOIS

## SYNCHRONOUS FLASHING OF FIREFLIES

IN a recent discussion of the synchronous flashing of fireflies, John Bonner Buck,<sup>1</sup> of the Zoological Laboratory of the Johns Hopkins University, contributes experimental evidence directly bearing on certain phases of this behavior as observed for some American fireflies.

In addition to the references mentioned by Buck, I have come across additional ones. Konrad Guenther<sup>2</sup> in 1931 says:

In Petropolis, on New Year's Eve, as I walked through the gardens in a fragrant summer night, the lawns were as though illuminated, and with astonishment I noted how hundreds of green lights blazed out simultaneously and were simultaneously extinguished, with so regular a rhythm that it seemed as though the sparks were blown rapidly by a huge mechanical bellows that gave a puff every second. Of this extraordinary phenomenon I could give no explanation.

<sup>1</sup> SCIENCE, 81: 339-340, April 5, 1935.

<sup>2</sup> "A Naturalist in Brazil." (Translated from German by Bernard Miall), pp. 227-228. Houghton Mifflin Company, 1931.

He refers also to the rhythmic flashing of the Indian fireflies.

F. P. Connor<sup>3</sup> refers to the "rhythmic flash of swarms of fireflies on a dark night, so beautifully seen in the Terai districts of this region [India]."

On July 22, 1933, I made a trip to the top of Hawksbill Mountain in the Blue Ridge of Virginia, pitching a tent on the plateau or Summit Pene plain just below the knob. As darkness came on, I began scouting over the pastures with a powerful spotlight. At 8:10 the first fireflies were seen in flight, spotting the darkness with an occasional flash of brilliant light. The flashes were never rapidly delivered, a considerable interval of rest always following each flash so that it was difficult to follow the insect in the darkness by its light. Even the flash itself was a leisurely delivery of light. Probably not more than eight or ten of these flying males were seen.

Points of light also came and went in the low herbage around, and these were traced to wingless females. The flying males and the wingless females were identified by Mr. H. S. Barber, of the U. S. National Museum, as *Photinus scintillans* Say.

I soon found that the flash of my light stimulated the flash of these wingless females. Their flashing response came very soon after the beam of my light went forth. I became much interested in the responses of these quiescent females. It was a matter of a nice synchronism on the part of a number of females every time I flashed my light. It was rather impressive to throw the spotlight over the low shrubbery one to two hundred feet away and to behold the reaction of half a dozen or more females flashing an almost immediate response with their tiny lights. This play with these insects continued for some time. At 8:30 the males had ceased to fly, but the females continued to respond to my flashlight in the herbage until 9:00 P.M., when their responses ceased.

In this instance the quiescent, wingless females were synchronizing their flashes in response to my light, and presumably they would behave in the same way to the perceived flash of a flying, flashing male. My stronger beam of light, affecting a far greater area, stimulated many or all the females to flash their signal, resulting in a nice synchronism within a scattered population every time I flashed my light. In this instance synchronism was experimentally induced in a population of females, but with a population of males flying and flashing around indiscriminately, there could have been no synchronism induced. At no time did the few males observed tend to flash in unison, and none were observed to descend to the females.

<sup>3</sup> *Jour. of the Bombay Nat. Hist. Soc.*, 36: 4, 1018, 1933.

While the observations I have reported appear to be relating to the mating impulse, I feel convinced that the remarkable synchronous flashing of many tropical fireflies does not necessarily fall in this category. A recent contribution by Hugh M. Smith<sup>4</sup> on the synchronous flashing of certain fireflies in Siam makes this plain.

The spectacular rhythmic flashing of groups of males as observed by Smith parallels perfectly the behavior of certain crickets and katydids, the snowy tree crickets, outstanding among these, which chirp in unison, not as a mating adaptation, but purely from some organic law of rhythmic appreciation which governs their chirping.

My original note in *SCIENCE*<sup>5</sup> appears to have led to the erroneous conclusion that the synchronism which I observed proceeded in waves from one or more sources. I did not observe a moving of the impulse in waves. My wording may have been a little ambiguous on this point. My use of the word "wave" as I have expressed it, "of alternate waves of illumination and darkness in the distance," had reference to that content of the word "wave" as a period of marked activity, as a *wave* of enthusiasm, not as an impulse moving along.

H. A. ALLARD

WASHINGTON, D. C.

## STUTTERING

IN a series of twenty-four cases of stuttering studied this summer in the laboratory of biolinguistics, at the University of Michigan, a marked improvement, even to a complete cessation of stuttering, was noted when the stutterer spoke while walking on all fours. When the stutterer assumed this position the arhythmicity and lack of coordination decreased.

As yet, no explanation of this phenomenon has been discovered. It is conceivably due to the reinforcement of reflexes. More specifically, stuttering as a spastic phenomenon may be caused by a temporary stimulus applied to an upper motor neuron. This might be due to a temporary dilatation of the capillaries of the precentral cortex. By the assumption of the quadrupedal position an alteration of blood pressure possibly ensues, which releases the blood that dilates the capillaries. Hence, the spasticity ceases and the patient carries on a more nearly normal conversation.

If this view proves correct, then present theories and methods for correcting stuttering should be revised and greater effort should be made to place them upon a physiological basis.

HAZLE GENIESSE

UNIVERSITY OF MICHIGAN

<sup>4</sup> *SCIENCE*, 82: 151-152, August 16, 1935.

<sup>5</sup> *SCIENCE*, 44: 710, November 17, 1916.



## SPECIAL CORRESPONDENCE

THE PROTECTION AND CONSERVATION  
OF THE ZOOLOGICAL LIFE OF THE  
GALAPAGOS ARCHIPELAGO<sup>1</sup>

IN the month of September, just one hundred years ago, a young man in his twenties landed from H. M. S. *Beagle* on an island of the Galapagos Archipelago. Twenty-four years passed without any one realizing the importance of that historic visit, and then in November, 1859, appeared a publication, which aroused a storm of controversy. The "Origin of Species" had forced the world to realize that something extraordinary had happened! It is particularly fitting on this centenary of the visit of Darwin that the Government of the Republic of Ecuador should take steps to recognize the intellectual acumen of the zoologist who made her island possessions famous, and to create a memorial to his careful observations of its strange life and his revolutionary theory of evolution, which resulted from the impinging of impressions of these extraordinary forms upon a peculiarly sensitive brain.

Since Darwin's time, the islands have been visited by pirates, whalers, scientists and wealthy yachtsmen. Lured to this desolate volcanic archipelago by varying causes, all have been astounded by the extraordinary creatures that live there. Every expedition to the islands has brought back reports of the rapid destruction of the strange life, of thousands of huge shells of tortoises, mute mementos of commercial greed, of the depredation by natives, whalers and other visitors upon the inoffensive birds and mammals. Public interest has been so aroused that many individuals and a number of organizations have exerted their influence in an endeavor to save such species as are approaching extinction.

The history of the effort to protect the extraordinary endemic species of the Galapagos Archipelago is one that has been marked by many vicissitudes, and has recorded, until recently, little but a series of failures. It is impossible in the limits of this paper to adequately record or even mention the many more or less isolated movements, to accomplish the purpose, which have

ranged from individual endeavor of loyal conservationists to helpful resolutions by international organizations, such as the Office International pour la Protection de la Nature, the Netherland Committee of International Protection of Nature, the Royal Academy of Sciences in Belgium, the Executive Committee of the Parc National Albert, the Carnegie Institution, the Fifth Pacific Science Congress and the American Committee for International Wild Life Protection.

No account of the assistance furnished by various organizations would be adequate unless it stressed the influence of the Carnegie Institution of Washington and the wise counsel of Dr. John C. Merriam, its president. For a considerable period of time Dr. Merriam has had contacts with various representatives of the Ecuadorian Government to the United States. Having frequently consulted with the Ecuadorian Minister concerning the desirability of protecting the fauna and flora of the islands and action to this effect by the Government of Ecuador, his co-operation has been particularly helpful to the American committee. He has always shown a keen interest in the preservation of the life of the Galapagos Islands, and his carefully considered suggestions, drawn from a wide experience of international affairs, have helped to build the basis for the final accomplishment.

Without question, one of the most influential factors has been the quiet and unassuming work of Harry S. Swarth, of the California Academy of Sciences, which has gone on for a period of years by personal correspondence. Mr. Swarth's letters to various individuals and organizations in the United States and abroad and his indefatigable personal effort has played a large part in the final success. He was greatly helped in arousing interest and support in European countries through the enthusiastic cooperation of Julian Huxley. Furthermore, Mr. Swarth's outstanding publication, "Avifauna of the Galapagos Islands," provided Dr. Egas and the writer with exact scientific material to serve as a basis for the laws and regulations, which were prepared and forwarded with Mr. Swarth's book to the Ecuadorian Minister of Foreign Affairs in May of 1934.

In 1928, Dr. Spillman, of Quito, Ecuador, visited Mr. P. G. Van Tienhoven, of Holland, and made suggestions similar to those so effectively fostered by Mr. Swarth. On the return of the *Nourmahal* from the Galapagos Archipelago in 1930, Dr. Townsend was visited by the consul of the Republic of Ecuador to New York in regard to a suggestion that the fauna of the Galapagos Islands should be preserved. The con-

<sup>1</sup> The American Committee for International Wild Life Protection wishes to express its appreciation of the far-sightedness of the Ecuadorian Government in the action they have recently taken for the protection of the zoological life in the Galapagos Islands. It is certain that such a course will meet with high approval among the scientific and conservation agencies of the world. We have asked Robert T. Moore, a member of the committee, to prepare an article giving the brief history of this subject. He has played a leading part in bringing this problem to the attention of the Ecuadorian Government.—HAROLD J. COOLIDGE, JR., Secretary.

sul had read the *Bulletin* of the Zoological Society for July-August, 1930, in which Dr. Townsend made suggestions relative to the preservation of the Galapagos fauna, and was inspired by these recommendations to make this visit.

Early in 1933 the American Committee for International Wild Life Protection, on which the writer represents the California Institute of Technology, took an active interest in the matter. Ever since then this committee has given its loyal support at all times to the efforts which have now proved successful.

Prior to membership on the board of the American committee the writer's connection with the project had been that of an independent lance, working largely through Ecuadorians since the year 1927, which marked the date of the first zoological expedition of the California Institute of Technology to Ecuador. These efforts had been of little avail until August of 1932, when the former consul of the Ecuadorian Republic to Los Angeles, Dr. V. M. Egas, who had been interviewed first in 1927, put his able and indefatigable enthusiasm behind the project, and since that time has continuously and persistently worked in cooperation with the writer to attain the desired results.

In April of 1934, after several months of collaboration with Dr. Egas, the so-called "Scientific Station of the Galapagos Islands Act" was completed and forwarded to the Minister of Foreign Affairs of the Republic of Ecuador. On May 5, 1934, the American Committee for International Wild Life Protection passed a resolution giving its "unqualified approval to this Act as worded." The resolution contained this sentence: "We are joining with other scientific institutions throughout the world in recommending to the government of the Republic of Ecuador, the creation of certain reservations (Asilos Reservados) in the Galapagos Islands and the preservation of the rare zoological species, which exist only in this Archipelago, and which have been made famous by the visit of Charles Darwin."

This was cabled to Ecuador. Subsequently the bill was returned for slight modification. It was once more forwarded to Ecuador in July, 1934, and on July 21 a supporting letter was addressed to the minister of foreign affairs. With remarkably little delay and accompanied by splendid cooperation from members of the Ecuadorian Congress and enthusiastic popular approval, the president and executive of the Republic of Ecuador, His Excellency Abelardo Montalvo, on the 31st of August, 1934, published by executive decree the most important of the regulations. This decree is known as "Poder Ejecutivo, No. 807, Parte Tercera." It is almost a literal translation in Spanish of the original regulations in English. I will brief the most pertinent passages from a translation

of the decree, prepared for the American Committee for International Wild Life Protection.

The most important objectives accomplished by the decree are as follows: (1) All the species which are in real danger of extinction are positively protected everywhere in the archipelago. (2) Rather heavy penalties are decreed for disturbing these species in any way. (3) All boats of every description visiting the archipelago must call at Chatham Island, and each applicant to land must sign a document agreeing to respect the laws protecting the zoological wild life. (4) A large number of islands are designated for sanctuaries and a permissive decree issued for their creation as such, so that whenever funds are available for financing of a warden with equipment to protect the reservations, the reservations may be formally set aside.

These islands are Isla Espanolo (Hood), Isla San Salvador (James), Pinzon (Duncan), Santa Fe (Barrington), Rabida (Jervis), Las Islas Seymour, Daphne, Tower, Marchena (Bindloe), Pinta (Abingdon), Wenman and Culpeper and a part of Isabela Isla (Albemarle) which begins at Punta Albemarle and extends two miles beyond Tagus Cove (Ancon de Tagus) and includes a strip of land a mile wide extending to the interior from the beach at low tide. The species which are protected are the fur seal, the sea lion, the sea iguana, the land iguanas (two species), the land tortoises (thirteen species), the albatross, Galapagos penguin, flightless cormorant, flamingo, Galapagos teal and Galapagos doves (two races).

It is obvious that legislation without enforcement is usually of little value. Until an efficient warden is appointed, financed and supplied with adequate equipment to protect the reservations, poaching may continue with more or less impunity. Nevertheless, this Ecuadorian decree makes possible the enforcement of an important clause in "Vandegrift's United States Tariff of 1930," covering the "Importation of Wild Mammals and Birds in Violation of Foreign Law." A brief quotation from its follows:

If the law or regulations of any country . . . restrict the taking, killing, possession or exportation to the United States of any wild mammal or bird, alive or dead, . . . no such mammal or bird, . . . shall after the expiration of ninety days after the enactment of this act, be imported into the United States from such countries . . . unless accompanied by a certification of the United States consul, for the consular district in which is located the port or place from which such mammal or bird . . . was exported from such country . . . that such mammal or bird . . . has not been acquired or exported in violation of the laws or regulations of such country. . . .

It is, therefore, apparent that since it will be difficult to import the zoological life of the Galapagos



Islands, alive or dead (without scientific permits), into the United States, from which country has originated nearly all the non-scientific expeditions that have threatened the extinction of these valuable primitive species, the incentive, which has been the chief lure for most of them, has disappeared. Furthermore, we are informed that an effort is being made to have similar laws to Vandegrift's Tariff Act, passed by the other important countries of the world with special reference to promoting a world-wide enforcement of the recent London Convention for the Preservation of the Fauna and Flora of Africa.

Admitting that this decree of the Ecuadorian president is merely the first step, it is not the intention of the American Committee for the Protection of International Wild Life to relax its efforts, but on the contrary to cooperate as far as possible with the Ecuadorian executive in promoting a proper means of enforcing the provisions of this decree, and thereby permanently insure the preservation of the extraordinary and primitive species which are still left in the Galapagos Archipelago.<sup>2</sup>

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## SOCIETIES AND MEETINGS

### THE SECOND GENERAL ASSEMBLY OF THE PAN AMERICAN INSTITUTE OF GEOGRAPHY AND HISTORY

At the closing session of the recent meeting of the Pan American Institute of Geography and History, held in Washington, D. C., the following officers were elected for a term of three years: For president and chairman of the executive committee, Dr. John C. Merriam, of the Carnegie Institution of Washington; for vice-president, Dr. Conde de Affonso Celso, Brazil, Dr. Roberto Andrade, Ecuador. Three honorary presidents were also elected: Dr. William Bowie, U. S. A., Dr. Rafael Belaunde, Peru, and Dr. Wallace W. Atwood, retiring president of the institute. The assembly expressed the desire to hold the next meeting, which should come in 1938, at Lima, Peru. The delegate from Peru expressed pleasure in the selection of his country, and before the day was over, through telegraphic communications, a very cordial invitation came from the Peruvian government to the Pan American Institute of Geography and History to hold their next general assembly at Lima.

The week from October 14 to 19, 1935, had been crowded with formal sessions, at which papers were presented by delegates from several of the nineteen countries represented in the institute, with social engagements and with excursions to places of special interest in and about the national capital. The State Department of the United States Government served as host, and the Hon. Cordell Hull, Secretary of State, gave the address of welcome on behalf of the government. Later in the week Mr. and Mrs. Hull tendered a reception at the Hotel Carleton to all delegates, and provided a very delightful entertainment. The National Geographic Society invited the delegates to their home, where they enjoyed a premier showing of the motion pictures taken by Bradford Washburn on his recent expedition, conducted under the auspices of the society, in Alaska. Following the lecture the dele-

gates enjoyed the very generous hospitality of President and Mrs. Grosvenor and other officers of the National Geographic Society. The Carnegie Institution of Washington arranged special exhibits and illustrated papers for a meeting held at their headquarters during one of the evenings of the assembly week and entertained the delegates most generously. His Excellency, the Ambassador from Mexico to the United States, invited the entire party to the Mexican Embassy.

At the first regular session held in the Hall of the Americas at the home of the Pan American Union, Dr. Pedro C. Sanchez, director of the institute, presented his report of the work of the organization since the first general assembly was held in Rio de Janeiro in 1932.

Among the many notable papers presented in various sessions were: "The Development of Maya Research," by Dr. A. V. Kidder; "The Agricultural Mayans," by Dr. Rollin S. Atwood; "Bolivar, Man of Peace—The Beginning of International Cooperation in America," by Dr. Enrique Finot; "Geography and History Among the Sciences," by Dr. John C. Merriam; "The Historical Meaning of Monte Alban as Indicated by the Explorations of 1932-1935," by Dr. Alfonso Caso; "The Redistribution of Population," by Dr. L. C. Gray; "Early Economic Crises in Cuba and Their Relation with United States Commerce," by Dr. Ramiro Guerra; "Economic Transformation of South America," by Dr. Clarence F. Jones. These and many

<sup>2</sup> Recently the Liberal Party has come into power in Ecuador and His Excellency Doctor Antonio Pons is now acting President of the Republic. Word has been received that the Liberal Party is actively promoting a movement for the protection of the resources of the Galapagos Islands and is interested in saving its wild life, which more than anything else has made the islands famous throughout the world. It is hoped that the next step will now be taken, either in the form of legislation by the Congress or a supplementary decree of the president, to establish the islands as permanent sanctuaries and legalize a method for enforcement.

others are now being assembled for publication in the proceedings of the assembly.

The Pan American Institute of Geography and History is the outgrowth of a suggestion made in 1928 at a conference held in Havana when ways and means for promoting intellectual cooperation among the people in the western world were under consideration. Later it was decided that the headquarters and permanent home of this institute should be in Mexico City. The Mexican government has provided an excellent building where offices, drafting rooms, library and private studies are available. During the years that have passed since its organization, the institute has conducted many important investigations. New maps have been published and a number of scientific monographs have been issued. Other maps are now under construction and archeological investigations are in progress. Through the generosity of the Mexican government and the cooperation of a number of the American republics, headquarters have now been established where scholars interested in geographical or historical research in the Americas will be given every possible assistance.

The Pan American Institute of Geography and History differs from most international organizations in that it is established for the active promotion of and participation in research.

Arrangements for the recent assembly held in Washington were made by an organizing committee, appointed by the State Department: Dr. Wallace W.

Atwood, *chairman*; Col. Claude H. Birdseye; Major William Bowie; Dr. A. V. Kidder; Dr. Waldo S. Leland; Mr. Hunter Miller; Mr. Richard Southgate. The President of the United States has furthermore appointed a National Committee to cooperate with the Pan American Institute of Geography and History. That committee is organized as follows: Dr. Wallace W. Atwood, *chairman*; Colonel Claude H. Birdseye, *vice-chairman for geography*; Dr. Clarence H. Haring, *vice-chairman for history*; Dr. A. S. Aiton; Dr. Harlan H. Barrows; Dr. S. W. Boggs; Dr. Herbert E. Bolton; Major William Bowie; Dr. Charles F. Brooks; Colonel Frederic A. Delano; Dr. Nevin M. Fenneman; Dr. Gilbert H. Grosvenor; Dr. C. W. Hackett; Dr. Ellsworth Huntington; Dr. Douglas Johnson; Dr. A. V. Kidder; Dr. Waldo S. Leland; Dr. Irving A. Leonard; Colonel Lawrence Martin; Dr. John C. Merriam; Mr. Hunter Miller; Dr. Parker T. Moon; Dr. Dana G. Munro; Dr. Robert C. Murphy; Dr. Lowell J. Ragatz; Dr. J. Fred Rippey; Dr. James A. Robertson; Dr. W. S. Robertson; Dr. Carl O. Sauer; Dr. France V. Scholes; Dr. Alfred M. Tozzer; Dr. Frank E. Williams.

Dr. Pedro C. Sanchez, the director, and Mr. Octavio Bustamante, the assistant director, continue to have immediate charge of the activities of the institute. Their offices are at the headquarters of the institute in Mexico City.

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## REPORTS

### PROPOSAL OF A PUBLIC MUSEUM OF SCIENCE ERECTED IN ST. LOUIS AS A MONUMENT TO THOMAS JEFFERSON<sup>1</sup>

IN 1903 preparations were being completed for a great exposition to be held in St. Louis in celebration of the one hundredth anniversary of the Louisiana Purchase and in honor of the memory of Thomas Jefferson. The "World's Fair" presented in wonderful exhibits the progress of nations in agriculture, industry, science and art. It was an educational institution on an immense scale, teaching by the practical objective method the throngs of people who attended. The exposition was maintained for eighteen months, then its costly collections were removed, the buildings, many of them beautiful examples of the architect's genius, were torn down and the World's Fair, which enlightened and inspired its visitors, became for them a fascinating memory to recall and to recount to another generation.

<sup>1</sup> Adopted by the council of the Academy of Science of St. Louis, October 3, 1935.

And now, in the present year, another opportunity presents itself to commemorate the author of the Louisiana Purchase, by the recommendation of the Federal Government and the promise of a generous sum of money to erect a permanent monument to Thomas Jefferson in St. Louis. On September 10, 1935, the city took its first step toward the realization of the idea, by voting a bond issue of \$7,500,000 for the purchase of the site on the Mississippi water front, as stipulated in the government's plan.

The government's recommendation does not name or suggest the kind of monument to be erected, and that important item is left to be determined by the presentation of ideas to be carried into plans for construction. In the conviction that the erection of a permanent monument is a settled thing, and imbued with the feeling that a public science museum would be an appropriate memorial, deserving of consideration, the following argument is submitted in its favor.

As far as possible the monument should reflect Jefferson's character and interests and indicate some of his achievements. As to the last, the building of the



memorial in St. Louis would in itself symbolize Jefferson's statesmanship in the conception and consummation of the Louisiana Purchase, the Lewis and Clark Expedition, Pike's explorations of the Mississippi and the Southwest and the settling of the valley and the west following the war of 1812.

Jefferson, it will be remembered, was one of the early Americans distinguished for interest in science. The pursuit of natural science and the application of scientific discovery to man's use and benefit interested him throughout his long life. He has been regarded as the founder of American paleontology. He is said to have dropped the practice of law because in his day it was unscientific. In all his work he invoked the scientific method, and his success in statesmanship can be attributed in no small measure to his habit of scientific reasoning and scientific treatment of political questions.

He was deeply interested in education. As the "Father of the University of Virginia" Jefferson formulated its organization, planned the layout of the grounds, selected its first faculty and subscribed generously to its financial support. His interest in education appears in his establishing the first public school system in Virginia, the Congressional bill for the diffusion of knowledge, his unsuccessful attempt to have Congress create a national university.

Architecture and landscape architecture occupied much of Jefferson's time and thought; the capitol in Richmond, homes of Madison and Monroe, the quadrangle of the University of Virginia, Monticello and its grounds, are among a rather long list of notable public and private edifices and gardens originally planned by or the results of Jefferson's expert architectural knowledge and advice. Jefferson was a lover of the beautiful in nature and in man's works, and, devoted to its cultivation in the nation, he labored by example to inculcate his belief in the effort to improve the standard of architecture both in cities and in rural surroundings.

One learns from his biographers that he was an accomplished musician; but his relation to music is much broader and deeper than is expressed by his performance on a single instrument. His music, his delvings in language and writings on ethics were not merely

brilliant flashes of a versatile personality, but outward signs and expressions of a rare studious, scholarly and philosophic mind. Jefferson's idealism did not make him the less practical, for he was always striving to invent useful things, to introduce plants beneficial to American farmers, to improve and simplify by eminently practical suggestions the reform of needlessly cumbersome procedures and systems.

No monument to Thomas Jefferson would satisfy that did not in some way impress the visitor with the feeling of freedom. Take away from the man all his traits and attributes but the hunger for freedom for his fellow men and most of Jefferson's character would remain. Inspired by reflections over the emancipation of men from bonds and tyranny of every sort he wrote the Declaration of Independence. A monument to Jefferson should create about it the atmosphere of freedom.

As already stated, the location of the monument would symbolize the Louisiana Purchase, the greatest achievement of its kind in the history of the United States and second only to the Declaration among the acts of Jefferson's statesmanship. A monument consisting of an architecturally superb building in spacious grounds, embellished with the best attainable landscaping effects, would conform to two of Jefferson's deepest interests. A building containing and exhibiting grand collections of natural objects and man's inventions, presenting the methods and results of scientific investigation and their application in agriculture, industry and the arts, to comprise a museum of science for the purpose of diffusing knowledge; asking no entrance requirements, demanding no tuition or laboratory fees, open and free for the youth and the man of the street to enter and acquire useful knowledge to the making of better citizens. A building hospitably planned to foster the scientific movement and the spreading of knowledge; to carry on perpetually the method of objective instruction that demonstrated its appeal to the popular mind by the myriad visitors to the Louisiana Purchase Exposition. A towering monument, symbolizing the spirit of Jefferson and the American ideal of democracy, arresting the eye of visitors from afar, a sign of the forward look of the people of St. Louis.

## SPECIAL ARTICLES

### THE CORRELATION OF DEEP-FOCUS EARTHQUAKES WITH LUNAR HOUR ANGLE AND DECLINATION

CERTAIN small variations in latitude previously announced<sup>1</sup> and corresponding small changes in longitude

<sup>1</sup> SCIENCE, 69: 17, 1929.

show an apparent correlation with the hour angle and declination of the moon.<sup>2</sup> The possibility of such small changes in geographical coordinates being asso-

<sup>2</sup> Monthly Notices Royal Astronomical Society, 91: 569, 1931, and March, 1935.

ciated with tidal phenomena in the earth's crust suggested a renewed study of seismic phenomena as a function of the moon's position. Recent results of Davidson<sup>3</sup> have indicated a connection between the frequency of earthquake aftershocks and the phases of the moon. Investigations by Father Rodés<sup>4</sup> have shown an apparent increase of seismic disturbances with the moon near perigee as compared with the moon near apogee. Some two thousand earthquakes have recently been investigated here from the point of view of a possible correlation of the frequency of their occurrence with the moon's position referred to the epicenter at the time the shocks occur. These studies have also included the relation of both major and minor earthquakes to the magnitude and direction of the tidal forces operating in the region of the epicenter at the time of the occurrence of the seismic disturbances concerned. While the treatment of all earthquake disturbances indiscriminately in such a study may be open to question, and the investigations thus far have yielded somewhat conflicting results, nevertheless a study of deep-focus earthquakes whose epicenters lie more than one hundred kilometers below the earth's surface has yielded a surprisingly striking correlation between the frequency of these deep-focus quakes and the horizontal components of the lunar tidal forces in operation at the time.

One hundred and twenty-two well-determined deep-focus earthquakes, taken from a list furnished me by Dr. J. A. Sharpe, of the Massachusetts Institute of Technology, have furnished the material for the results summarized in Table I. This selected list includes only those earthquakes whose depth of focus exceeds one hundred kilometers and for which an ample number of reliable observations have been secured. In Table I is listed the number of occurrences of these deep-focus quakes for twenty-four equal intervals

TABLE I  
TABLE SHOWING RELATION OF FREQUENCY OF DEEP-FOCUS EARTHQUAKES TO THE LUNAR HOUR ANGLE

Hour angle of moon	Number of quakes	Hour angle of moon	Number of quakes
0	7	12	3
1	2	13	4
2	3	14	5
3	5	15	9
4	8	16	9
5	5	17	6
6	8	18	5
7	6	19	9
8	1	20	2
9	2	21	2
10	0	22	5
11	5	23	2
12	3	24	7

<sup>3</sup> *Jour. Geol.*, 42: 5, July, 1934.

<sup>4</sup> *Ass. Seis. Trav. Sc.*, Ser. A, Fasc. 10: 87-90, Strasbourg, 1934; Lisbon Congress, 1933.

corresponding to hourly values in the changing hour angle of the moon referred to the epicenter at the time of the occurrence of each deep-focus earthquake. The

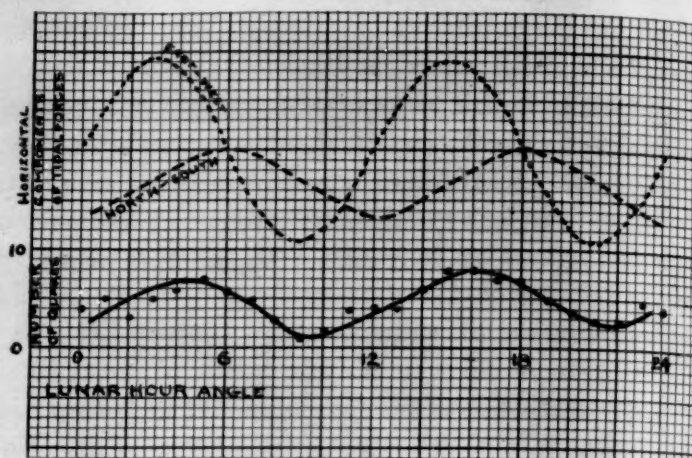


FIG. 1. Upper curves (dotted), Horizontal Components of Lunar Tidal Forces. Lower curve (full), Earthquake Frequencies vs. Lunar Hour-angle.

full line curve printed herewith is drawn through points representing the running means of the numbers of earthquakes for hourly intervals. The broken line curve represents the north and south component, and the dotted line curve the east and west component of the horizontal lunar tidal force for the corresponding hour angles and declinations of the moon. It will be observed that the curve of earthquake frequencies shows a much closer correspondence to the curve representing the east and west component of the lunar tidal force than to the curve representing the north and south component. A curve representing the resultant of the north-south and east-west curves would resemble the earthquake frequency curve with striking similarity.

It should be stated that Dr. Sharpe's list shows that the bulk of these deep-focus earthquakes occur in four regions—the Japanese Archipelago, the East Indies, the west coast of South America and the Himalayas—the greater number of deep-focus quakes in the list lying in the first three regions mentioned.

It seems hardly conceivable that the gravitational lunar tidal forces of the order of  $10^4$  dynes/cm.<sup>2</sup> can be sufficient to be any major cause for the high energy disturbances recorded. The significance of the curve relationships herewith shown may offer some new evidence for the hypothesis of trigger action, or furnish a basis for further speculation as to other causes which may be dependent on the lunar period. A more extended report will be published elsewhere on the results of these investigations.

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## GROWTH AND SURVIVAL OF MICRO-ORGANISMS AT SUB-FREEZING TEMPERATURES

WITH the consumption of frozen fruits and vegetables steadily increasing, the attention of a great number of food technologists is focused upon the behavior of microorganisms at low temperatures.

In July, 1933, during a routine examination of frozen strawberries, raspberries and cherries packed in Oregon in June, 1930, it was noted that while the number of viable microorganisms to be found in the fruit, after three years' storage at 15° F., was so small as to be practically negligible (average less than 70 per gram), there were an unusually large number of interesting species to be seen on the plates. These organisms, representing many species of bacteria, yeasts and molds, were studied in pure culture form and later identified as closely as possible with known species.

Largely from curiosity concerning the behavior of these forms on artificial media at low temperatures, freshly made beef infusion agar, adjusted to pH 7.0, slant cultures of each of them were placed in the 16° F. room of the cold storage building at the Arlington Experiment Farm, Virginia. The cultures were placed in this room within 30 minutes from the time transfers were made. The cold storage room is carefully controlled and maintains a fairly even, recorded temperature of 16° F. (-8.89° C.).

The cultures were examined every month, and it was not until the end of the third month that slight but definite signs of growth were observed on three of the slants, all of which were yeasts. In all three of these species of yeasts, the morphological and cultural characters would place them among the true yeasts, in the family *Saccharomycetes*.

Hitherto the lowest temperature known to the author at which growth takes place in any yeast was found in the recent data of Berry and Magoon,<sup>1</sup> who reported growth taking place in *Torula* sp. at -4° C.

The amount of growth in these yeast cultures at the end of a year at -8.89° C. was still slight, being about equal to the amount formed in 18 hours at room temperature.

Between the fifth and seventh months, more cultures—namely, *Bacillus atterrimus* Lehmann u. Neumann, *B. fluorescens* Ford, *B. mycoides* Flügge, *B. ruminatus* Gottheil and *Penicillium* sp.—showed slight but definite growth. In these cultures as well as in the yeast, growth at the end of a year while thin was sufficiently extensive to leave no doubt as to its presence.

At the end of the year all the cultures were brought into the laboratory, allowed to thaw out and incubate

at room temperature for twenty-four hours; *Dema-tium* sp., *Monilia* sp., *Oidium* sp., *Penicillium* sp. (second strain ?), and an unidentified yeast failed to grow. The others, including those mentioned above as showing positive signs of growth at -8.89° C., produced an exceptionally large amount of characteristic growth in 24 hours.

The species showing this abundant growth on the same slants at room temperature after a year's storage at -8.89° C., but showing no signs of growth while held at this temperature were: *Bacillus albolactis* Löffler (Migula), *B. cereus* Frankland, *B. graveolens* Gottheil, *B. lobatus* Bergey, *B. atterrimus* Lehmann u. Neumann (second strain ?), *B. mycoides* Flügge (second strain ?), *B. polymyxa* (Prazmowski) Gruber, *B. subtilis* (Ehrenberg) Cohn, *B. vulgatus* Trevisan, two species of *Penicillium* and two species of unidentified yeast.

To summarize: twenty-six species of bacteria, yeasts and molds which were able to keep alive in frozen fruit held at 15° F. for three years were isolated, studied in pure culture form and identified with known species as closely as possible. Freshly made agar slant cultures of each species were held at 16° F. (-8.89° C.) for one year. Eight species were able to produce growth at this temperature, thirteen species, while showing no signs of growth at 16° F., did produce abundant growth when the cultures were removed to room temperature and allowed to incubate 24 hours. Only five species out of the twenty-six failed to survive the storage period of one year on artificial media at 16° F. These findings make it plain that many species of microorganisms have remarkable faculties for survival as well as for adapting themselves to changes in environment and must be taken as a warning against careless methods in the preparation of frozen foods.

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## A NEW ANTAGONISTIC PROPERTY OF NORMAL SERUMS: THE CERCARICIDAL ACTION

THE destructive action which normal serum manifests against many bacteria, some kinds of protozoa and certain filterable viruses is well known. To our knowledge, however, no such behavior of the normal serum against multicellular organisms has been described. During the past summer (1935), it was our privilege in the Helminthology Laboratory of the University of Michigan Biology Station at Douglas Lake, Michigan, to test *in vitro* the normal serum of divers animals upon a number of species of cercariae, one of the larval stages of trematode parasites. It was found

<sup>1</sup> J. A. Berry and C. A. Magoon, *Phytopathology*, 24: 7, 780-796, July, 1934.

## THE EFFECT OF THE SERUMS OF VARIOUS ANIMALS UPON DIFFERENT SPECIES OF CERCARIAE

Species of cercariae	Group of cercariae	Vertebrate serums						
		Man	Rat	Cat	Herring gull	Water snake	Green frog	Bullhead fish
<i>Cercaria of Schistosomatum douthitti</i> <sup>2</sup>	Schistosome	o	o	o	o	+	+	
Undescribed cercaria	Schistosome	⊕	+	o	⊕	+	+	
<i>Cercaria elephantis</i> <sup>4</sup>	Schistosome	+	+	o	+	+		
<i>Cercaria physae</i> <sup>5</sup>	Strigeid	+	+	o	+			+
<i>Cercaria of Diplostomum flexicaudum</i> <sup>6</sup>	Strigeid	o	⊕	o	⊕	⊕	+	⊕
<i>Cercaria of Diplodiscus temperatus</i> <sup>7</sup>	Amphistome	+	+	o	+	+	+	

+ : all cercariae killed ; ⊕ : some cercariae killed ; o : no cercariae killed.

that the serums of many animals have a definite cercaricidal action, the parasites readily losing their characteristic activity and finally becoming so distorted in shape and appearance as the result of contact with the serum that they could not be recognized as cercariae. The substance in the serum responsible for the cercaricidal action is inactivated by heating or desiccating the serum and is quickly lost by the serum in storage.

The relative potency of the cercaricidal action of a serum can be estimated by determining the greatest dilution of serum in physiological salt solution which, added to an equal volume of a suspension of cercariae, kills all the organisms after the mixture is incubated for 1 hour at 37° C. A total volume of fluid of 1 cubic centimeter containing from 25 to 75 cercariae generally proves satisfactory in the test.

Serums of representatives of all classes of vertebrates manifest the cercaricidal action, the following, among others, having been tested for the property: mammals—man, cat and white rat; birds—domesticated duck and herring gull (*Larus argentatus smithsonianus*); reptile—water snake (*Natrix sipedon sipedon*); amphibian—green frog (*Rana clamitans*); and fish—bullhead (*Ameiurus nebulosus*). All these serums, save that of the cat, were found active against at least some species of cercariae, although the cercaricidal titers varied between broad limits. For example, against a strigeid, *Cercaria physae*,<sup>1</sup> the titers of human, rat, cat and duck serums were, respectively, 1:48, 1:192, zero and 1:24. Representatives of each of the different groups of cercariae tested proved susceptible to the action of the serum, although they differed much in their susceptibility to specific serums. If, finally, conclusive evidence can be adduced for the

existence of a relationship between the cercaricidal action of the serum and the resistance of a vertebrate to infection with a specific cercaria, the cercaricidal test with serum would assume importance in the selection of vertebrate hosts in experiments to complete trematode life histories.<sup>2</sup>

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<sup>2</sup> To be published in *extenso* in the *Journal of Parasitology*.

<sup>3</sup> Cort, *Jour. Parasitol.*, 1: 65, 1914.

<sup>4</sup> Cort, *Jour. Parasitol.*, 4: 49, 1917.

<sup>5</sup> Cort and Brooks, *loc. cit.*

<sup>6</sup> *Idem.*

<sup>7</sup> Krull and Price, *Occasional Papers of the Museum of Zoology, University of Michigan, Ann Arbor*, No. 237; 1, 1932.

## BOOKS RECEIVED

GOURLEY, JAMES E. and ROBERT M. LESTER. *The Diffusion of Knowledge*. A list of books made possible wholly or in part by grants from Carnegie Corporation of New York and published by various agencies during the years 1911-1935. Pp. x+314. Carnegie Corporation of New York.

HASLETT, A. W. *Unsolved Problems of Science*. Pp. xi+316. Macmillan. \$2.00.

HUEY, EDWARD G. *A Child's Story of the Animal World*. Pp. 355. Illustrated. Reynal and Hitchcock, New York. \$3.50.

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<sup>1</sup> Cort and Brooks, *Trans. Am. Micros. Soc.*, 47: 179, 1928.